# ELECTRICAL REVIEW

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## Electric Light, Power, Telephone, Telegraph and Scientific Progress.

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### VIEWS, NEWS AND INTERVIEWS.

In 1883 a submarine observatory was constructed by Signor Toselli at Naples, enabling visitors to see the bottom of the sea. It was a steel chamber with plate glass floors and a collapsing float to sink it to different depths. It carried eight persons and was illuminated inside by electric light, while telephones communicated with the shore. It was quite possible to take photographs inside it beneath the water.

Something like two years ago the American Telegraph Company erected a line of unusually large and fine looking poles between Ansonia and New Haven, says the Ansonia *Sentinel*. A large number of the poles were of Southern cedar, and these were, perhaps, the best looking ones in the lot. The inspectors, however, in making their trips over the route have found that these poles seem to weaken very quickly, and an investigation discloses the reason. The poles, it seems, are the homes of numerous insects, and the woodpeckers were quick to discover the fact, and in their pecking for the insects have literally honeycombed many of the poles, rendering it necessary for them to be replaced with new ones. In one short stretch of the line, through what is known as Coe lane, three of the poles were fairly destroyed by the predatory birds.

Several electric supply men, wire dealers and constructing engineers who had dealings with C. H. Lawrence in connection with an electric railway at Lockport, N. Y., will be personally interested in the following press dispatch which was sent out from Erie, Pa., May 29:

"Charles H. Lawrence, who has been engaged in the jewelry business here for a few weeks under the name of Charles H. Ingersoll, was arrested yesterday by the sheriff of Lockport and taken back to stand trial for stealing a part of a street car line in that city. A year ago Lawrence came from the East and was elected manager of the Lockport street company's lines, and while changing it from a horse-power to electric motor is charged with selling the cars and a part of the track and appropriating the money. He was indicted for grand larceny, but managed to get away before trial."

Fred H. Whipple, whom the electrical fraternity know quite well, is managing a theatrical troupe now playing "O'Dowd's Neighbors" at the Columbus Theatre in Harlem.

Thomas A. Edison is now seen quite frequently in Wall street. His hair is grayer than it used to be, and it is said that he realizes that he must not work as hard as he has in the past. More of his evenings are spent at his charming home in Orange than formerly, when he almost lived in his laboratory.

A young man who has suddenly jumped into prominence in the financial and electrical world is A. O. Tate, Thomas A. Edison's chief aide and manager of the Edison Manufacturing Company. Mr. Tate came to New York from a small Canadian village about nine years ago. Through the influence of a friend he got a $30 a week position in Mr. Edison's office at No. 65 Fifth avenue as a shorthand writer. The great inventor soon realized that his secretary was capable of doing better work, and he instructed Samuel Insull, his first assistant, to look after him, and as soon as an opportunity presented itself he was to be promoted. In a few weeks Tate took the position of second bookkeeper. Then he declared that he could look after all the books himself. In two years' time he filled the positions of cashier, office manager and manager of the Phonoplex and Mimeograph Companies. Finally he found himself in charge of the Edison laboratory. It was Mr. Edison's personal wish that Tate should be near him. When the reorganization of the Edison General Electric Company took place Mr. Tate was appointed manager of the Edison Manufacturing Company. This successful young man is only 29 years of age. He lives in a quaint little villa in Llewellyn Park, Orange, within a stone's throw of the palace occupied by his chief.—*New York Morning Advertiser.*

The vaults of the sub-treasury at San Francisco are being fitted with electric wires for protection from thieves. The wires are to be between two rows of bricks, and any attempt to interfere with the cement or bricks will complete an electric circuit and sound a warning.

### Gas Caused the Fire.

A sub-committee of the Committee on Public Buildings and Grounds has made a report to the House of Representatives that the fire in the folding-room of the House and adjacent premises on March 22, 1892, was the result of the ignition of a pile of documents from a gas jet near where these documents had been piled. The committee also finds that this fire is not the first of its kind. The foreman of the folding-room testifies that similar fires occurred in 1884, 1887, 1889, 1891 and in February, 1892. The last fire, the one in March, caused a damage of about $1,000. The committee also reports a resolution that the architect of the Capitol be authorized and directed to substitute electric lights instead of gas in the premises occupied by the House folding-room. This is an encouraging report, in view of the fact that electricity is unjustly blamed for causing so many fires.

### Canadian Electrical Association.

The first annual convention of the Canadian Electrical Association will be held at the Board of Trade rooms, Hamilton, Ont., on Tuesday, Wednesday and Thursday June 14, 15 and 16. The programme of proceedings is as follows:

Tuesday, June 14, 11 A. M., meeting of the executive committee; 2.30 P. M., opening session; president's address; reading of secretary and treasurer's report; election of officers for ensuing year and other business; 8 P. M., visit to the Hamilton Electric Light and Power Company's new station.

Wednesday, 15, 10 A. M., paper on "Long Distance Telephoning," with illustrations, by Mr. Hugh Neilson; paper on "Central Stations," by Mr. D. Thomson; paper on "Carbons," by Mr. H. O. Fisk; 2 to 3 P. M., visit to the new exchange of the Bell Telephone Company; "Financial Aspects of Electric Lighting," introduced by Mr. S. J. Parker; paper on "Steam and Electric Power," by Mr. J. J. Wright; paper on "Multiple Switchboards," by Mr. Baylis; paper on "Possibilities of Electric Railroading," by Mr. W. A. Johnston; 8 P. M., excursion to Hamilton Beach; luncheon at the Ocean House; band concert.

Thursday, 16, 9.30 A. M.; paper on "Line Construction," by T. H. Wadland; paper on "Safe Wiring," by A. B. Smith; 11.30 A. M. to 1 P. M., drive to principal points of interest in the city.

Ample hotel accommodations and reduced railroad fares have been secured. The convention headquarters will be at the Royal Hotel. Mr. J. J. Wright is president of the Association and Mr. C. H. Mortimer is secretary and treasurer. This being the first convention a large attendance is expected.

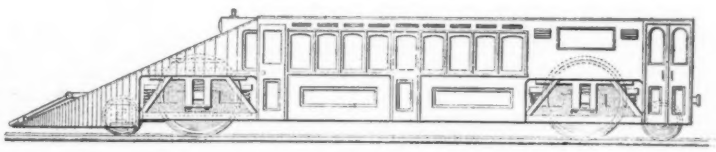

FIG. 1.—DR. WELLINGTON ADAMS' HIGH SPEED ELECTRIC CAR FOR THE PROPOSED CHICAGO AND ST. LOUIS ELECTRIC RAILWAY.

### The King of Siam Believes in Electrical Progress.

Among the recent names added to the subscription list of the ELECTRICAL REVIEW is that of His Majesty, Somdetch Phra Paramindr, Maha Chulalongkorn, Supreme King of Siam, who lives in Bangkok, Siam. This cultured and progressive ruler is an extraordinary man in more than one way. He speaks eleven languages and is a thorough believer in scientific progress. Recently he, in person, broke ground for the first steam railway from Bangkok to Korat, and through his efforts the street railway in Bangkok, which is now operated by ponies, is to be changed over to a trolley road, the Short Electric Railway Company, of Cleveland, having secured the contract.

The Siam Electric Light Company was organized last year at Bangkok, with a capital of about $15,000. The stock was subscribed within three days and paid up in full. The company obtained a very favorable franchise from the King and the plant was built and put in operation. It is now suffering from mismanagement, and it is understood that the plant is for sale. The chief cause of trouble seems to be that experienced Europeans have not been secured to take charge of the plant. There is no gas in Bangkok, and kerosene oil is at a high price. There should be no reason why the Siam Electric Light Company should not have a brilliant future under the rule of so progressive a government as is inspired by the King.

### From Chicago to St. Louis by Electric Express.

DR. WELLINGTON ADAMS EXPLAINS HIS SIX MILLION DOLLAR SCHEME TO THE MEMBERS OF THE ELECTRIC CLUB.

Farmer Dunn evidently did not want Dr. Wellington Adams to have a large audience at the New York Electric Club last Thursday evening. The Farmer had provided one of the hottest June days which New York has known, but in spite of this fact the alluring title of Dr. Adams' address drew together about 150 members and their guests, who sweltered and suffered and were vastly interested in what the doctor had to say. Among those who sacrificed their comfort and melted their collars were ex-President Henry C. Davis, Prof. George Forbes, of London, O. T. Crosby, H. Ward Leonard, Dr. Emory, E. A. Leslie, E. P. Morris, George M. Phelps, Carl Hering, T. C. Martin, Stephen L. Coles, Horatio A. Foster and Harold Binney.

In the absence of President Insull, who was in Chicago, not as a coincidence but on a matter of business, Treasurer George M. Phelps occupied the chair and introduced Dr. Adams as a speaker who had devoted much time and thought to a very interesting subject. It was about half-past eight when Dr. Adams took up his position between a white screen and a stereopticon and launched forth into poetry. He said that he remembered reading a few years ago a little couplet, which ran as follows:

"Will you walk a little faster?" said a whiting to a snail,
"There's a porpoise close behind us and he's treading on my tail."

This sentiment the doctor considered as very *apropos* to the present aspect of rapid transit. The speaker referred to the establishment of the first electric street railway in Ireland, and said that its success led the people to want more rapid transit. Following the development of horse and steam railways down to date, Dr. Adams said that all people who had advocated these schemes had been known as cranks, and that he was proud to be known as a crank.

"For a long while," said he, "I have been in favor of long distance railways for high speed cars. I began to work in this direction in 1884, but found it impossible to do anything until within the last year. I have been greatly helped by the recent advances made in electric transmission of power. I formulated my ideas in Europe last year after consulting with a number of prominent engineers, and determined to put my project in operation upon my return to this country. I wanted to build a line between Boston and New York or Philadelphia and New York on account of the immense traffic between these points, but difficulties in the character of the country were too great. The laying out of a straight line of railway would be impossible without such excessive cost as to make it financially impracticable. On the other hand, between Chicago and St. Louis we have 250 miles of country as level as a floor and well adapted to the construction of a straight line of road. I have found it practicable to construct an absolutely straight line which is for 200 miles perfectly level. I have also taken into

account the holding of the World's Fair, and consider this an opportune time to develop my scheme.

"There are two important steam railways between Chicago and St. Louis, the Chicago and Alton and the Wabash line. Between these two is a territory which is not traversed in the same direction by any steam road. This is the country through which I have projected my high speed electric railway line. I have formulated my plans and started off three corps of engineers, using the government triangulation stations, and ran three roads from Chicago to St. Louis. We found that one line was absolutely practicable. The distance was 248 miles, being 34 miles shorter than the shortest existing steam railway. In this distance our line came in contact with only 10 houses, none exceeding $800 in value. This is explained by the fact that the line runs diagonally through all the sections of the country. We did not strike a single church or graveyard or river in the direction of its course. We have been very fortunate in securing rights of way and grants of land. A steam railway could not secure a line through this country for love nor money, but people realize that our scheme is a new one and deserves to be encouraged, hence the ease with which we have secured our rights of way. The maximum grade of this line will not exceed two per cent., and this only occurs at one or two places. There are 20 grades of two per cent. at railroad crossings with approaches of 1,000 feet on each side. These are not to be considered.

"From its natural advantages and favorable location I have the greatest faith in the future of Chicago as the largest city in this country. It is the center of the largest grain producing area in the United States, and when the projected ship canal is finished Chicago will be placed in direct connection with England, which is the largest food consuming portion of Europe. There are over 1,200 through passengers traveling between Chicago and St. Louis every day. These are valuable points as distributing centers. It is estimated that during the World's Fair 30,000,000 people will visit the grounds. We think that our high speed electric railway will be as much of a curiosity as the Fair, and if 10 per cent. of the people visiting the Fair travel on our road out of curiosity alone, we think we shall not be expecting too much. The fare for the round trip from Chicago to St. Louis will be $5. The road will cost $6,000,000 to build. It will be more of an attraction than the Eiffel Tower at the Paris Exposition, which paid for itself during the exposition and turned in a handsome profit besides. The government pays $105,000 per year for the transmission of the through mail between Chicago and St. Louis.

"We will locate along the line two central stations. We started with the idea of one central station, but thought that if a cyclone or tornado or flood should destroy that one the line would have to stop. With two stations, if one breaks down the remaining station can operate the road. At Wilmington we have found a water power which develops 10,000 horse-power during ten hours a day. We are negotiating for the purchase of this power. At Edinburgh we have a 1,500 acre coal mining property, the mine producing 1,500 tons of coal a day. Our road runs within 50 feet of the shaft of the coal mine at Edinburgh, within 100 feet of the water power at Wilmington, and within 500 feet of the coal mine at Fairburn, near Wilmington. We will divide the road into four sections of about 55 miles each. We have secured about 60 per cent. of the rights of way.

"By using a straight line we save extra construction and maintenance of way and the wear and tear on rolling stock caused by curves. We will run spurs to the adjacent towns cut off by the main line, and trains from these towns, to either Chicago or St. Louis, will be run through without stops. Between Chicago and St. Louis through cars with no stops will be run at 100 miles per hour, making the trip in two and one-half hours. We will build two tracks at first for through traffic. Eventually we shall have two middle tracks for express trains and two outside tracks with light rails for way trains, or to be run as a street car system. The southern starting point is near Madison, opposite St. Louis. We will terminate our road in Chicago at Ninety-fifth street, connecting with the alley elevated roads, which run directly to the Fair grounds and to the Auditorium hotel. Rights of way through the cities of St. Louis and Chicago have already been secured at a very small cost.

"A well constructed and well drained road bed is required. With our two track road which we will start with there will be a ditch in the middle between the two tracks and one on each side. We will use a 70-pound California rail, which is a practically continuous rail and requires no fish plates. We will use the overhead trolley center pole construction. The cars will be low and heavily weighted, the roof of the car being nine feet from the top of the rail. This enables us to build cheap bridges for highway crossings. The trolley is placed over one

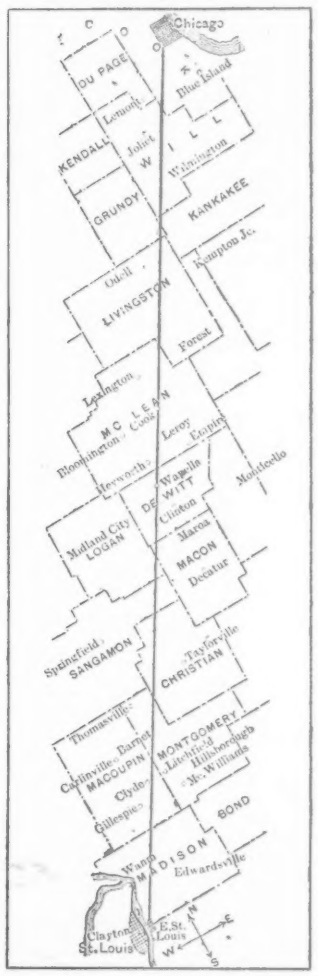


FIG. 2.—LINE OF THE CHICAGO & ST. LOUIS ELECTRIC RAILWAY.

side of the car practically on a level with the roof. The road is fenced in on both sides throughout its entire length. Each car will be fitted with two pivotal bogie trucks with 31 inch pilot wheels in front and rear. The weight of the car comes directly on the two driving wheels. The front of the car is pointed, having the form of a truncated pyramid or cone. If the exigencies of the traffic demand it, we can run two cars at once, joined by their square ends. We are building at the present time one car and two trucks. The driving wheels are six feet in diameter. Motors will be rigidly mounted on each car axle. The motors will weigh 6,132 pounds and will develop 200 horse-power at 500 revolutions per minute. They will be alternating current motors having no commutators, brushes or switches. The armature is mounted rigidly and the field is journaled on the axles. We will use cushion wheels, giving a vibration of one-half an inch to obviate the deleterious effects of a rigidly mounted motor on a rigid road bed. On the forward pilot axle there will be a rotary air pump to provide air for the brakes. We will use electric brakes, too."

Dr. Adams then threw a slide upon the screen illustrating the method of suspending the trolley wire, which is ingenious. A slack cable is suspended between two poles. From this slack cable depend supports, varying in length with the drop of the cable, so that when their lower ends are connected to the trolley wire, the latter is maintained in a straight line.

"Current will be taken from the trolley wire," continued the speaker, "by two sliding contacts held in place by a trolley wheel 12 inches in diameter and constructed like a bicycle wheel. The wheel is designed to keep the sliding contacts on the wire. We require a large contact surface in order to take down to the motors 100 amperes of current. The trolley plates are on spring contacts. The trolley contacts are placed outside of the motor-man's cab door, where they can be easily got at or oiled. We expect to use a rotary current multiphase system. We have made an experimental motor of four horse-power, which starts and stops at all speeds and has an efficiency within five per cent. of a direct current motor. We shall use 500 volts initial pressure at our central stations, which will be transformed up to 25,000 volts. We will divide the line into sections of 10 miles each, with a transformer station for each section where the current is brought down to 3,000 volts. The trolley wire is 000 size."

Dr. Adams then discussed at considerable length the limits of steam locomotive speed, arguing the disadvantages of a complicated steam machine using reciprocating motion, as against a simple electrical motor using a rotary motion.

"The fuel question is a very important one. In producing coal at our mines we accumulate an immense amount of slack, which is an expense to us to dispose of. This slack we propose to use for fuel in our central station. Our system is cheaper than a steam railway operated at 60 miles per hour. We get rid of skilled labor, we require no brakeman and no conductor. The motor man has no boiler to watch, nothing to do but stop and start his motors. He is enabled to take the tickets of the passengers, and this one man can take 40 persons through from Chicago to St. Louis. We believe we can pay for our road during the six months of the World's Fair, and we are now working hard on the scheme."

When Dr. Adams had finished speaking, the stereopticon man turned off his light and the big glass electroliers in the club parlors blazed forth. Mr. Phelps said that he had no doubt Dr. Adams would be glad to have his remarks criticised by any of those present who were familiar with the subject.

Mr. O. T. Crosby said that he agreed with Dr. Adams on the desirability of such a high speed railway as he had mentioned. He knew the difficulties in the way. He was frank to say that he did not believe such a road could be built in so short a time. The most vulnerable point of attack was the electric motor which it was proposed to use. He was unable to discuss the matter because there were no details of the motors. The method of delivering the current was certainly an ambitious one. Not having dealt with the problem except in an orthodox fashion, Mr. Crosby did not feel confident to speak further.

Professor George Forbes, of London, said that the lecture had been an extremely interesting one and was also difficult to discuss. There were two important questions. First, the construction of the road bed, and second, the electrical problem. In regard to the road bed, Dr. Adams seemed to have ignored the old fashioned methods that we were all accustomed to. There was another way which had been adopted by but two men in the world's history. These two men were the Emperor Nicholas, of Russia, and Dr. Wellington Adams. The method was to take two points and draw a straight line, which is your railway. The Emperor Nicholas succeeded in building his railway after encountering a great many difficulties and spending a great deal of money. Dr. Adams seemed to have met no difficulties, in which he was especially fortunate. Professor Forbes thought it would have been extremely interesting to follow the three different parties of engineers all exploring on the same straight line. He could not believe that the road could be constructed in six months. The problems presented were of the utmost interest and he thought it would be a very great feat to supply this enormous power through a single conductor. The motor was very wonderful if it would produce 200 horse-power at 500 revolutions and the weight named. He agreed with Dr. Adams' advanced ideas of rapid transit, but he could not enthuse with the doctor on the advantages of a straight line road.

In reply, Dr. Adams said that he owed very much to the writings of Professor Forbes, which he had read in the Journal of the Society of Arts in 1882 and 1883. He did not mean to say that his motor would be within five per cent. of the efficiency of the direct current motor. He was referring to his experimental machine, and in this he had sacrificed efficiency.

Mr. E. A. Leslie moved a vote of thanks to Dr. Adams, which was seconded and passed.

During the two hours and a half in which Dr. Adams spoke, the audience seemed very much interested and at the same time very warm. Professor Forbes was seen to make several calculations with a pencil on his cuff, each of which was followed with a smile. Mr. Morris had a pencil and a card with which he figured occasionally. Certain statements which the doctor made seemed to send a current of electricity through the room which attracted men's heads until they almost came in contact, the operation being accompanied by whisperings and motions. When the lights were finally turned on the audience presented a rather dazed appearance, but this was not for long. They realized that the lecture was over, and that in order to save what remained of their lives they must have fresh air. It was a very hot night.

## The Advance of Electricity.

A LECTURE DELIVERED BY PROF. EDWIN J. HOUSTON, OF PHILADELPHIA, BEFORE THE DEPARTMENT OF ELECTRICITY OF THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES, BROOKLYN, N. Y., JUNE 1, 1892.

Great ideas or inventions can be arranged under three great types or classes, viz., 1. Immature or incomplete; 2. Mature but unripe; 3. Ripe.

Ideas or inventions of the first type produce but little effect in the world—at times, however, they tend to direct thought to certain channels and thus act as forerunners of greater and more valuable ideas.

Ideas of the second type are mature, but the times are unripe for them; the condition of the environment unsuited; and, therefore, though matured and complete in themselves, like unripe fruit, they produce no progeny for the development of the world.

Ideas or inventions of the third type are of far greater value to the world than those of the second type, since they bear fruit almost immediately. Prof. Youmans expresses it as his opinion that great ideas belong to eras rather than to individuals; that intellectual progress may move in waves toward the boundaries of the unknown, and many investigators moving with that wave may, at very nearly the same time, discover new features and facts on the horizon beyond.

Beginning with the oft reverted to experiment of the Greek Thales; it was not much, when viewed in the light of the world at its birth, some 600 B.C.; merely a piece of amber rubbed against the clothing; merely the gaining of a strange property of first attracting and then repelling light objects brought near it. It was, however, the birth of a great idea, that, unfortunately for the world's progress, belonged to the class of immature ideas. Viewed in the light of to-day, its importance can hardly be overestimated. It pointed out a *terra incognita*, an unknown realm of phenomena, that occupied nearly the entire domain of nature, and only waited patiently to be observed. However, it bore no fruit until thousands of years later. Examining Thales' original experiment in the light of to-day, we should care-

fully avoid forming hasty conclusions: (1) That all the forces of nature have been discovered. (2) That any correctly recorded natural phenomena is of no value to the world. It seems strange from our standpoint that the existence of the electric force could have remained so long unrecognized. It was not for the want of acute minds, as the Egyptians, Greeks and Romans were in many respects as intellectually developed as any of the present races.

Prof. Houston, at this point, rapidly but interestingly reviewed the early experiments of Gilbert, Stephen Gray, Franklin, Von Kleist, Galvani, Volta, Sir Humphry Davy and others, and then continued, after paying a high compliment to the work of Nikola Tesla, as follows:

It was not until the great and only Faraday conducted that magnificent line of experiments between 1831 and 1832, on the means for producing electricity from magnetism, that the road was opened up for the production of a new electric source in a dynamo-electric machine. Nor was it until Sorens Hjorth and Gramme, together with numerous others, produced the modern dynamo, was a ripe invention offered to the world. It was, unquestionably, the classic investigations of Faraday in the domain of magneto electric induction that gave to the world that most wonderful and efficient electric source, the modern dynamo electric machine. The successful production of the modern type of dynamo machine probably found its first exponent in the completed Gramme machine. This machine gave that impetus to electric science which, beginning about 1874-75, has continued to the present day, and furnishes one of the best examples of remarkable progress along a particular line of science that the world has ever seen. To attempt to trace the history of the dynamo-electric machine would carry this paper to undue length. Faraday built far better than he knew. Could he see the many forms of dynamos which are in all parts of the world now converting mechanical energy into electrical energy, with wonderful efficiency, he would thus appreciate the almost immeasurable gift that he freely gave to the world.

The invention of the modern dynamo made possible the invention of the electric motor, which during the past few years has been successfully carried to an extent that appears almost incredible. Already electricity as a motive power is successfully competing with steam in a number of cases.

Let us not overlook the telephone. Looking at it from a strictly scientific standpoint, it affords an admirable instance of the combined applications of three great inventions which we have just been discussing, namely, the dynamo electric machine, the electric motor and the long distance transmission of electric power.

An outgrowth of the telephone appeared in the phonograph, the invention of Edison. This instrument is familiar now to all.

There are many other inventions, which lack of time compels me to pass unnoticed. I know how dangerous it is, even under the most favorable circumstances, to assume the position of a prophet; yet I desire to venture a few suggestions concerning what seems to me electric science has in store for the human race in the near future.

(1) A cheaper means for the production of electricity than is now obtainable by burning coal for the purpose of driving a steam engine, which in its part turns a dynamo electric machine. This invention will probably be found in some improvement in thermo-electricity, whereby coal will be burned directly to produce electricity, and not through the double intervention of the steam engine and the motor.

(2) The entire replacement of the steam engine by the electric motor. I do not think it unreasonable to believe that many in my audience to-night will live to see the steam engine relegated to the scrap pile as antiquated and possibly even to hear it spoken of in their times as an indescribable instance how an otherwise bright age should remain satisfied for so long with such a clumsy contrivance for the conversion of energy.

(3) The successful solution of the problem of aerial navigation, effected possibly by means of the electric motor, and acting as a result in the improvements in the production of electricity. In my own mind this problem needs for its successful solution only means for controlling great power under small weight.

(4) The replacing of the electric light, that is, the present electric light, with its preponderance of useless and injurious low heat energy, by some means of electrically produced light, which shall possess a smaller proportion of the useless heat rays and a larger proportion of light rays. Though this discovery may come by the discovery of some means of producing cold light by chemical phosphoresence, yet it would seem more probable that it would be by means of physical phosphoresence or by means of molecular bombardment, as pointed out by Nikola Tesla in his classic experiments on the effects produced by alternating currents of extraordinary high frequency and difference of potential.

(5) A more intelligent means than are now adopted in the therapeutical applications of electricity applied to the curing of diseases, whereby human life may be considerably prolonged and human suffering lessened.

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An electric car on the Paterson, N. J., Main street line was successfully used in chasing and capturing a horse thief who was getting away with a team that had been hitched in a hotel shed while the owners regaled themselves.

## The San Francisco and San Mateo Electric Railway.

San Francisco's pioneer electric railway—the San Francisco and San Mateo—which was formally opened on April 26, as noted in the ELECTRICAL REVIEW, is, in many respects, the most interesting and best equipped electric street railway on the Pacific coast. San Francisco, as many are aware, boasts of the most extensive cable railway system of any city in the world. The city is extremely hilly, and for this reason it was thought the electric railway would not meet with the success that had attended its introduction into other cities throughout the State. With the successful opening of the San Francisco and San Mateo road these views have been dispelled, and it is now conceded that the formerly undisputed field of the cable has been invaded by a formidable rival.

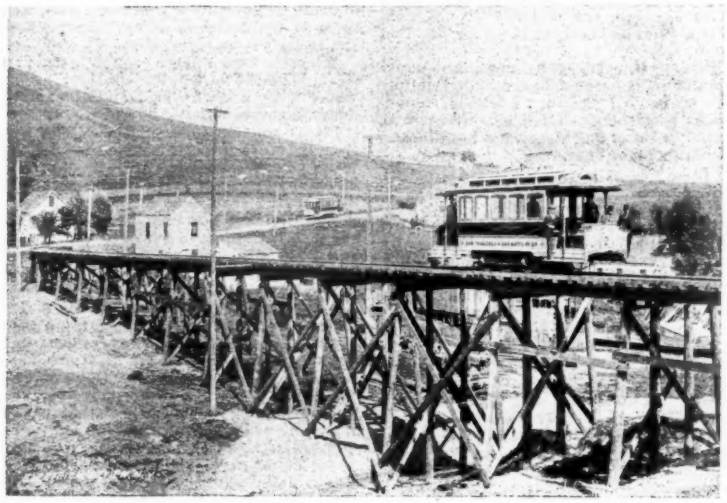


FIG. 1.—CROTON STREET TRESTLE, SAN FRANCISCO AND SAN MATEO ELECTRIC RAILWAY.

The road was equipped by the Thomson-Houston Company, and is a model of good construction. It is 10 miles in length, the present terminus being Holy Cross Cemetery, but is being extended to Baden, two miles distant. Work has also commenced on the Golden Gate Park branch. Ultimately, the town of San Mateo, distant about 30 miles, will be reached, right of way having already been secured by the company.

There are now in use 30 cars. Fifteen have double trucks and are equipped with two 25 horse-power motors, while the remaining 15 have single trucks with two 15 horse-power motors. Power is furnished by six Thomson-Houston generators, the capacity of each being 80 kilowatts. Two more generators of like pattern have been ordered and are now on their way. These generators are driven by two triple expansion Corliss engines of 500 horse-power each, built by the Risdon Iron and Locomotive Works, San Francisco. Five 500 horse-power Stirling water tube boilers are used. There is in use the largest cooling pond in the State.

The power house, located at Sunnyside, is very commodious and conveniently arranged. A separate incandescent plant furnishes light to the car house after midnight. The handsome switchboard is of Spanish cedar, and the instruments are all slate based. It was designed by F. F. Barbour, the Thomson-Houston company's efficient engineer. To this gentleman, under whose supervision the road was constructed, too much credit cannot be given.

Many heavy grades are encountered. The steepest is the Harrison street, which is 14 per cent., while Guerrero street, which comes next in order, has an 11⅝ per cent. grade. A severe test was given one of the double truck cars on the Guerrero street grade recently. One hundred and ninety-three persons managed to crowd the car, and with this load the grade was ascended with apparent ease. Three hundred and fifty-five feet of trestle is in use on Croton street near the power house.

At first the company was unable to secure right of way to the ferries, but it has now been secured and this short branch is being rapidly constructed.

A description of San Francisco's first electric railway would not be complete unless mention was made of J. W. Hartzell, who, with others, labored incessantly in the State Legislature and with the Board of Supervisors until all obstacles had been surmounted and a franchise received. The president of the company is Behrend Joost. Mr. Hartzell is secretary and general manager.

FIG. 2.—HARRISON STREET 14 PER CENT. GRADE, SAN FRANCISCO AND SAN MATEO ELECTRIC RAILWAY.

## The New England Electric Club.

The New England Electric Club opened its new quarters at 14 Bosworth street, Boston, with a house-warming on May 25. The house is four stories high, fitted with electric lights, call bells and all conveniences. A large number of members and guests assisted at the opening ceremonies, which were very enjoyable.

## Ampere-centimetre, a Measure of Electro-Magnetism.

READ BEFORE THE ELECTRICAL SECTION OF THE FRANKLIN INSTITUTE, BY CARL HERING.

It appears from the following deductions that an electric current multiplied by the length of the circuit will represent the number of magnetic lines of force generated by this current, or, in other words, that the number of lines of force generated by a current can be measured by the product of the current and the length of its circuit. A unit current passing through a unit length of circuit appears to generate a certain fixed and constant number of lines of force. This, of course, has reference to the electro-magnetism of the current itself and does not include the influence of any magnetic bodies in the neighborhood.

First of all it is necessary to show that amperes multiplied by length will give a unit of a similar nature to magnetic lines of force or flux, in order to show that an equivalent between the two may be given without transgressing the laws of physics. This may be shown conclusively by the aid of the dimensions of these units in the absolute system. The dimensions of current is $m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}$, while that of magnetic flux (that is, number of lines of force, not their density per square centimetre usually represented by $H$ or $B$, nor the intensity as it is sometimes called), is $m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}$. It will be seen that the former multiplied by a *length* gives the latter. This shows conclusively that ampere-centimetres, or ampere-feet and magnetic flux are units of the same kind and can, therefore, be equaled.

Having determined this point, the following appears to show that every unit length of a circuit conveying one ampere generates a fixed and constant number of lines of force. Using absolute units, the intensity of magnetization (or number of lines per square centimetre) at the center of a circle of one turn, according to the well-known formula, is

$$H = \frac{2c\pi}{r}$$

in which $r$ is the radius in centimetres and $c$ is the current.

Now, the intensity of the field is different in different parts of the area enclosed by the circle, being greatest nearest to the wire, but it may be assumed that in all circles, large or small, the ratio of the intensity at the center, to the average intensity in the whole circle, is a constant. Let this ratio be called $K$, then the total number of lines will be equal to the intensity at the center multiplied by the area, and by $K$; that is

$$M = \frac{2c\pi}{r} \times \pi r^2 \times K = 2c\pi^2 r K$$

By dividing this by the circumference will give the number of lines per unit length of the circuit.

$$2c\pi^2 r K \div 2\pi r = C\pi K$$

or per unit of current, this is equal to $\pi K$. It will be seen that this is a constant and is *independent of the radius* $r$. This means that the number of lines per unit length and per unit current is the same for all circles, and therefore also for a straight line, which is a circle of infinite radius.

From this it appears that, knowing this constant number of lines per ampere per centimetre or foot, the calculation of the total number of lines generated by any circuit or coil, would merely be the product of the current, the length of the circuit, and a constant.

It should be remembered, however, that this deduction supposes theoretical conditions; that is, a filamentary wire having no appreciable diameter. How far the size of the wire introduces an error remains to be determined. At all events, if the diameter of the wire is small as compared with the diameter of the coil, and specially if the coil, as it usually does in practice, contains iron which appears to concentrate the lines in it, and, therefore, probably attracts those circulating in the body of the wire itself, it may doubtless be assumed that the ratio of the flux in two coils would be equal to the ratio of their ampere-feet, which proportion might be of use in dynamo construction.

The above deductions were made by the writer a number of years ago, but as they did not appear to agree with some existing laws at that time the matter was laid aside. It seems, however, that subsequently some dynamo builders have advocated and used this system of calculation in preference to the other, and it was therefore thought best to publish this proof, hoping that some others, well informed on this subject, might point out the discrepancies, if any, and perhaps show the extent of the application in practice of calculating the magnetic flux of a current from the ampere-centimetres of the circuit.

## Some Points for the Electrical Engineer.

READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, ILL., JUNE 6 TO 8, 1892, BY HORATIO A. FOSTER.

Although it is the province of this Institute to consider largely the more theoretical side of electrical engineering, and rightly so, it is, perhaps, well that it should occasionally have brought to its attention that outside practical part, only for which theory would have no backing and therefore could not reach its proper development.

It has been the fortune of the writer during the last 10 months to visit and inspect, both technically and financially, considerably more than a hundred central lighting stations.

Taken as a whole, it really seems as if much of the ordinary commercial common sense and the usual keen judgment of self-interest had been on a vacation when these plants were erected. In many cases this traces back—first, to the wiles of that slickest of all individuals the agent, who is always willing to assure the buyers that his system of lighting will virtually run itself, and then to the fact that people were formerly so doubtful of the prospective profits that on going into the business they invested the smallest amount that would start the work. The consequence was, bad construction, bad machinery, bad lines, and, of course, an entirely unreliable service. Oftentimes the man put in charge was a novice, and that worst of all novices for the business, the local amateur electrician; and is it any wonder that the business was a failure for the first few years?

In some localities this condition still obtains, nothing having been done but to patch up the bad work of the past.

In a few cases the administration has been changed by putting at the head some substantial and tried business man, very much to the benefit of the concern. While, in many instances, even the large city plants suffer from the above causes, they also suffer from other conditions inherent in the size of their field.

The pioneers were so timid about the outcome, that the city station was invariably very much too small, and inside of two years had become so patched up and crowded that rebuilding became necessary, and this, in many cases, was repeated two or three times.

There is probably no business extant which has been built over so many times, and that has had the same quality and quantity of brains applied to it, that is in such chaos as to the proper design of building and arrangement of machinery. In cotton or any other weaving industry, machine shops, foundries and similar establishments, it has long been determined which is the best form of building to erect, and those put up in the last ten years or so of a similar industry, are planned in the same lines, differing only in size to suit the special case. Now, this not only fails to be the case in electric lighting, but outside of the two prominent systems of connecting the dynamo to its power—that is by direct belting to fast running engines, or by counter shaft to larger slow running engines—there are scarcely a half dozen stations in the State built on the same or similar lines.

So much diversity of opinion is shown in designing these stations, and oftentimes by those whose opinion should have no weight, but unfortunately does, that it has the effect to convince some of the investing public that the electrical engineer does not know his business, and they might as well go it alone.

If some action could be taken by this Institute through a committee, which should examine into proper station design and report on some few general plans and suggestions as to lines to be followed, it might go far toward establishing a better backing for our members who are in that branch. As it is I think it will be acknowledged that far more electrical engineering skill is applied to the larger isolated plants; and that the central stations are enlarged or rebuilt under the management of the local superintendent or board of directors, who frequently lack technical knowledge or even familiarity with recent improvements elsewhere. Quite often this is owing to the fact that the only experience they have had with an electrician has been the generally young, inexperienced expert, who was sent out to install the first plant, and they think they can make better use of their money by controlling it themselves.

The method of distribution should also have consideration, especially in reference to the amount and style of underground work which certain sizes of city will be able to stand.

This may seem a large question, but you can be assured it is one of the most vital to the future welfare of the industry. It may be said that it is not well to interfere in private business, and that electrical engineers can be trusted to remedy the evil. I assure you the electrical engineer individually "is not in it," to use a vulgar phrase, and, sad to say, has never been in it to any extent. Quite often officials of the electric lighting companies take a jaunt through the country visiting different stations for models for a new one for themselves. This often results in a worse muddle than ever, as they seldom find two stations at all similar, and they return resolved to use their own judgment.

This leaves the real electrical engineer out in the cold at a point where, if known, he could, by consultation, do much good; but many of these company officials never heard of the American Institute of Electrical Engineers and need to have it brought to their notice in some way.

Some may think that in time the electrical engineer will be called in and consulted, as are engineers of other works, but at the present rate I am afraid many will be angels or worse before the majority of electrical central station companies come to that point.

Perhaps if instances be mentioned under the following heads a better understanding can be arrived at, viz.: Location, foundations, construction of station, motive power, arrangement of machinery and location and construction of lines.

### LOCATION.

The location of plants is not now so generally bad as in the past, although we occasionally find a station in a location for which no excuse is apparent, as, for instance, one located in the basement of a carpenter shop at a long distance from fuel supplies and only plenty of condensing water to recommend it; insurance rate, three per cent. or more. Another located nine miles away from a village of 2,000 people to take advantage of water power never surely available all the year, and since destroyed entirely for the greater part of the year. Another placed so low down in reference to its water-power as to be flooded in freshets. Another located more than a mile from fuel supplies, and the center of distribution at the top of a long, steep hill, with not even free water to recommend it. Another so located in relation to a very intermittent water-power as to be unable to take advantage of the water for condensing purposes and now running the poorest kind of a slide-valve engine. Another located in a rickety, old, uncared-for part of a gas house, where coke is scarce, and apparently plenty of water-power available within a half mile.

Another located a long distance from center of distribution and coal supplies, to take advantage of cheap land and cheap fuel, the last of which has since proved very unreliable, when seemingly land could have been had much more central, with a much surer supply of cheap fuel, and to cap all, the value of that land has since increased enough to have paid the entire cost of the station at any moment it be desirable to sell.

One advantage of some of the older centrally located stations has since been learned in the increase in value of such real estate. One such station visited will enlarge and rebuild soon, and will sell its present real estate for enough advance to go far toward paying for the new station, and there are others which can, I think, tell the same story. In fact, in the present problematical growth of the future, a well-selected piece of ground may prove a very valuable part of the investment.

### FOUNDATIONS.

Foundations are now much better than in the past, and some of those now placed under dynamos would sustain almost anything that could be put on them. Poor foundations are occasionally seen though, as, for instance, those under a large bank of boilers in a station which was erected and started in six weeks. The boilers have since lurched forward until the fronts are some two or three inches out of plumb. In fact too little attention seems to have been paid to boiler foundations as a general thing.

Engines have fared better and when the ground has been good the foundations are to be little criticised.

One station has very large Corliss engines and owing to water soaked ground and limited time in which to build the brick foundations, they were placed wholly above the floor level of the dynamo room, and belts run both ways from the fly-wheels to shafting on either side of the room.

Very few bad dynamo foundations are now met, but many unbalanced armatures are found which no amount of foundation would hold steady.

### STATION CONSTRUCTION.

In station construction there has been no settled design, therefore the promoters have generally built as they saw fit, occasionally following suggestions of the agent. Of course, many plants are located in buildings already up in which case the machinery had to be made to fit.

In many of those built especially for the work, no attention has been paid to designing for a low insurance rate, and brick stations are found sheathed all over the inside with pine, the one thing that insurance inspectors always criticise. A couple of coatings of whitewash or paint would have been much cheaper, safer, and looked quite as well.

When stations have been remodeled, very little improvement has been made in the smaller ones, but those in large cities have generally taken advantage of all the improvements to date, if not too strongly attached to some one parent company.

### MOTIVE POWER.

The selection of motive power has, of course, been governed by local conditions; in the northern and northwestern part of New York state, water power is abundant and is largely used as motive power for stations, but almost invariably with steam reserve.

Water power alone has been found very difficult to govern for uniform speed, and some of the devices used for that purpose are, to say the least, ingenious.

When the load is large enough to use part steam there is no trouble whatever, as the wheel takes a steady load and the engine does the governing.

Plants are sometimes placed a long way from the work in order to take advantage of water power and in some cases it seems as if all else had been sacrificed to that one point.

Of engines there is no end to the different design, style and size used. Some use high speed, belted direct to dynamos, others slow speed belted to counter, some simple non-condensing where compound condensing would be decidedly best.

I know of at least three plants located in water works pumping stations using high speed simple non-condensing engines on a practically steady load, all of which have been erected during the past three or four years.

Two stations I remember having an all night and every night load of arc lights and situated on a lake shore which run high speed simple non-condensing engines.

To offset this there is one station that deserves mention as it embodies many points of value. The building is substantial, of brick, two stories high and on a river bank. The boilers are very efficient and well set, the engine is a moderate speed compound condensing, with shaft extended for three dynamo pulleys, and one for the power condenser. There is a heater between the exhaust and condenser and a power pump attached to one side of the condenser. The flow to the boilers is governed by a bye pass valve, as the pump is, of course, in motion all the time the engine is running. This station has only an arc load and runs all night; it was built entirely under the supervision of a local mechanical engineer with the exception of connecting the lines and dynamo terminals to the switchboard, and would, I think, be hard to beat for results.

### ARRANGEMENT OF MACHINERY.

The arrangement of machinery is as diverse as the style of motive power; when direct belting is used the arrangement is generally simple and plain, but oftentimes so crowded as to be very inconvenient.

There seems no end to the arrangement of shafting, some have a line shaft through the middle of the dynamo room and belt both ways to dynamos, others a shaft on either side of the room belting up to dynamos in the center, others the shaft under the floor belting up to dynamos and occasionally to engines also, others have the shafting overhead; in fact, there is no end to the styles, some good and some bad. In most cases friction clutches are used with shafting for stopping individual dynamos and some few may use loose pulleys on independent sleeve for the same purpose.

The length of belt centers varies greatly, some apparently thinking if long belts are better than short, very long ones must be much the best.

The improvement in switchboards seems to me more marked than in any other one department, which is probably owing to the pressure of insurance men who look at the switchboard as the most dangerous fire risk of all.

### LINE CONSTRUCTION.

In line construction I cannot see that any very marked improvement has been made, excepting in some cases, the substitution of larger and better poles for the older ones.

The use of black covered wire in place of white, has perhaps made the lines a trifle less conspicuous but that is about all. The lines still have the apparent aimlessness of direction mentioned by Prof. Thomson at Buffalo.

People in the larger interior cities are already agitating the question of underground wires and it seems probable that unless something is done soon by the companies themselves to rid the streets of the more conspicuous of these wires, there will be very costly trouble for them to contend with.

It can no longer be denied that wires are working well every day in subways and the only valid argument against them is extreme cost. Nevertheless when the general public learns this fact, cost will have little to do with the argument.

In many places wires can be removed from the main streets to alleys back of the shops, and the extra cost will be decidedly cheaper than underground work. In such few places as have already done this, wires are inconspicuous and the underground question is never raised.

In street lighting the favorite method is the cable suspension across the street. Where the work is neatly done this serves very well but it would be difficult to find a more unsightly thing than some of the lamps so suspended.

Considerable trouble is occasioned in the above method by breakage of the wires at the joint with the line and at the cross bar over the hood. There is no apparent reason why twin or duplex wire should not be more used for this purpose, instead of the kinked and straggly single wires.

There are many other methods, some of them good in principle but bad in the application, and so it goes.

It seems to me that if some action was taken by a non-partisan association like this Institute, an advance toward better engineering might be made, if a few general laws could be suggested to be followed in laying out the different parts of a lighting station. Perhaps it may be said that much of the above work should more properly come before the National Electric Light Association, but as many of that society are members of this Institute, I feel sure they would individually appreciate its backing in the future when the time comes for enlargement, and they have need of combined expert opinion.

## TRADE NOTES.

Among the important contracts recently secured by the Hill Clutch Works, of Cleveland, O., is one from the Hartford Electric Light and Power Company, whose plant they have fully equipped with their well-known clutches and pulleys.

The Richmond Railway and Electric Company, and the electric light station at Harrisburg, Pa., are now both supplied with a complete outfit from this enterprising concern.

Owing to the increased demands of business, the Fletcher & Fletcher Electric Company, of Cleveland, O., are enlarging their present quarters as much as possible, and contemplate moving into a larger building as soon as a satisfactory location can be found.

The firm have been doing an exceedingly prosperous business in their medical batteries, and have orders at present for all they can turn out.

The Woodland Avenue and West Side Railway Company, of Cleveland, O., have decided to adopt electricity as a motive power on their lines, and have just closed a contract with the Westinghouse Company for 50 motors for the equipment of their lines. Contracts have also been closed with the Brill Company for 35 of the cars, and with the St. Louis Car Company for the balance.

Work on the power house will begin immediately, and the plant will consist of three Cooper compound Corliss engines of 500 horse-power each, and one of 360 horse-power.

The Detroit Electrical Works, of Detroit, Mich., who have the contract for the equipment with electricity of the Jefferson avenue line in that city, report that work is being pushed in the various branches of construction with all possible energy, and no pains will be spared to make the outfit equal to anything in the country.

The contract for the poles has been placed with Milliken Bros., of New York, and the steam plant will be furnished by Westinghouse, Church, Kerr & Co. This will consist of three Westinghouse 14x24x14 compound engines, three tubular boilers 66 inches by 16 feet, one Hoppes feed-water heater, one Worthington duplex steam pump and Hancock inspirators.

The 100 kilowatt multipolar generators will be furnished by the Detroit Electrical Works, and will embrace all the latest improvements, which are of considerable importance. The overhead construction will commence at once, and will extend over six and one-half miles of single track.

Detroit has long suffered from the lack of proper rapid transit facilities, and as this is the first road to adopt the system of electric traction, the gentlemen in charge of the work are determined that everything in connection with it shall be of the highest order, and the results lead to the universal adoption of a system so greatly needed. They expect to have the road completed and in running order about July next.

### Direct-Acting Electric Hoist for Flat Wire Rope.

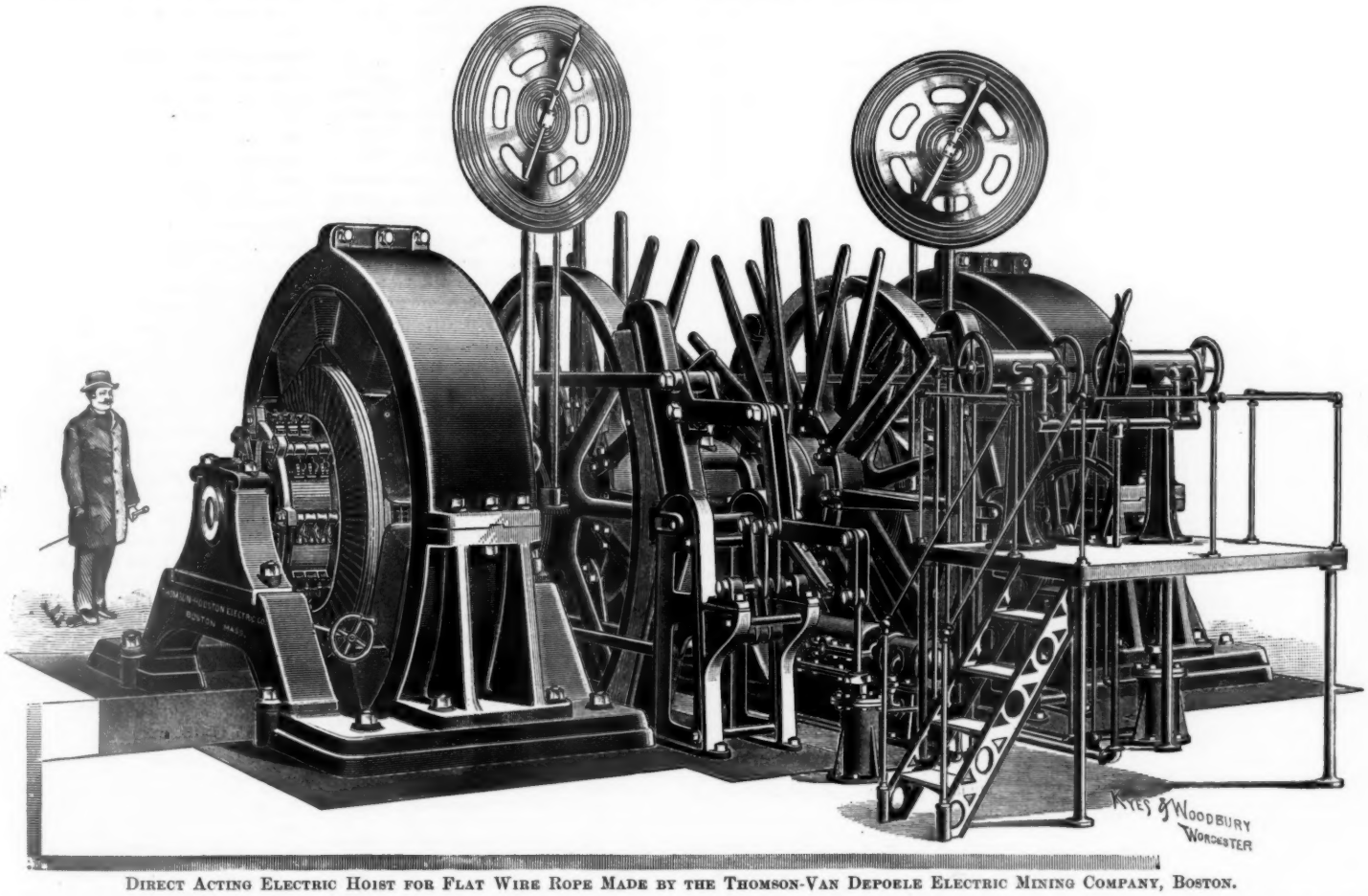
The rapid hoisting of heavy loads from deep mines by the direct application of the power to the reel shaft without the intervention of gearing, offers the most favorable conditions for the use of the electric motor in hoisting work. Much greater economy can be shown in the use of power, while a high hoisting speed can be safely and easily attained, a matter of importance where large quantities of ore are to be handled. Gearing has its limits, both in speed and safety.

Herewith is illustrated a direct-acting electric hoist using flat wire rope, operated by two "P. M." type motors, one on each end of the reel shaft, each capable of developing 500 horse-power, or having a combined output of 1,000 horse-power. This hoist is built by the Thomson-Van Depoele Electric Mining Company, Boston, and is designed to raise a load of 10,000 pounds from a depth of 2,500 feet in one minute. Of course, for hoisting and lowering men, or for other purposes, any desired speed can be obtained at the will of the operator. Lowering can be done under complete control of the motors and without the use of the brakes when desired. Post brakes of a very powerful and effective type are used, being drawn together by rods above and below the reel shaft so that all parts move in parallel lines, distributing the wear equally on the brake shoes and applying the pressure at two points in each shoe equally distant from the center. The shoes are also pivoted at the center so as to quickly adjust themselves to the faces of the brake wheels. The clutches are of the jaw type, that portion of the shaft upon which they slide being hexagonal in form. Both clutches and brakes are operated by cylinders using compressed air. A small air compressor driven by an electric motor is placed at the center of the hoist, supplying air for this purpose. The compressor requires no attention whatever, being automatic in its action; stopping when the pressure in the receiver forming its base reaches a certain point, and operates entirely independent of the hoist. Two sets of valves, actuated by hand wheels, one for brake and one for clutch, are placed convenient to the operator on each side of the center of the hoist, each set controlling the brake and clutch on its side. A powerful, reliable and positive means of operating both clutches and brakes is thus provided, requiring practically no exertion on the part of the engineer.

The brake wheels, reels, etc., are, as will be seen, of the usual form, the brake wheel being keyed to the hub of the reel, which runs loose upon the shaft when not in clutch. The reel hubs are bushed with hard composition, means for their thorough lubrication and easy removal being provided.

Dial indicators operated by worm gears on reel hubs are attached to each reel, showing the position of the cage in the mine shaft. All levers are arranged within easy reach of the operator, so that one man can attend to both reels and brakes without difficulty. Particular attention has been given to the motors, so that all adjustments can be quickly and easily made and access had to all parts. They are mounted on heavy bed plates, also used for the two bearings at each end of the reel shaft. A rheostat of ample capacity is provided for obtaining the slower speeds, resistance being thrown in or cut out by means of a controller and lever for operating. A reversing switch and lever for lowering is also provided.

The extreme compactness and simplicity of this machine as compared with direct-acting hoisting engines fitted with their complicated cut-off valve gear, will at once be noted. Only about one-half the space is occupied, as by steam hoists of the same capacity, insuring a great saving in buildings and foundations alone, while the well known economy of the electric motor in the use of power makes its application to direct-acting hoists requiring large power of the utmost importance in a commercial sense.




DIRECT ACTING ELECTRIC HOIST FOR FLAT WIRE ROPE MADE BY THE THOMSON-VAN DEPOELE ELECTRIC MINING COMPANY, BOSTON.

### The "Kelvin."

The Board of Trade authorities have decided to call the kilowatt hour the "Kelvin" in official documents for the future. No one has greater respect for Lord Kelvin's intellect than we have; but all the same, we cannot but feel that to name the kilowatt hour after a living electrician, who may be acting as consulting engineer to various corporations, is at least in bad taste. The kilowatt hour, or Board of Trade unit, does not belong to the C. G. S. system, and, therefore, did not need a nondescriptive name. Electricians are a little apt to make themselves ridiculous in the eyes of others by calling things after members of their own profession. Imagine the gas acts being altered so that instead of "1,000 cubic feet," the householder would be charged so much per "Livesey."—*London Industries.*

### A New Electric Launch.

The representatives of the electrical press were invited to the trial trip of the new electric launch "Electra" on the Passaic river, at Newark, N. J., Friday of last week. The boat has just been completed by the Electric Launch and Navigation Company, of 120 Broadway, N. Y., and is the first of a fleet of such boats which it is expected will be in use on the water-ways and lagoons at the World's Fair. This company has acquired from the Consolidated Electric Storage Company the exclusive right to use their storage batteries for boat propulsion. The officers of the company are: E. J. Moore, vice-president and acting-president; C. H. Barney, general manager and Fred. Reckenzaun, electrician.

The "Electra" is 31 feet over all; 30 feet on the water line; has a beam of 6 feet and a draught of 26 inches. She is built on fine lines, enters and leaves the water very easily, is constructed of white cedar and oak, with mahogany trimmings, and was designed by Mr. William Gardner, of Gardner & Mosher, 1 Broadway, New York. Mr. Gardner will be remembered as the designer of the "Norwood," the very fast steam yacht belonging to Mr. Norman L. Munro, of New York. The "Electra" complete without passengers weighs about two and one half tons. The electrical equipment consists of 78 cells of the Consolidated Electric Storage Company's batteries, each cell weighing 38 pounds. The cells are filled with a gelatinous electrolyte which prevents the spilling of any disagreeable liquids in the boat. The motor is situated amidship below the floor of the cabin, and was designed by Mr. Anthony Reckenzaun. It is of four horse-power, weighs 420 pounds and runs at 650 revolutions per minute. The propeller shaft, made of Tobin bronze, runs in ball bearings and is connected directly to the armature shaft. The motor has a capacity of four horse-power, and the boat may be run at four speeds, of three, seven, nine and 11 miles per hour, respectively. At the normal speed of seven miles the boat may be run for 10 hours without recharging the batteries. At this speed the rate of discharge of the batteries is from 30 to 35 amperes. At the normal speed, two sets of cells, 39 cells each, are connected in parallel. At the maximum speed all the cells are connected in series. The controlling switch is a wheel mounted inside of the pilot wheel shaft, both of which are placed in the bow of the boat. The switch is of novel construction and was designed by Mr. Fred. Reckenzaun.

The "Electra" is exceedingly stiff, well balanced and roomy. About 30 passengers can be carried with ease, and protection is afforded by an awning hung on a brass frame work. There will be 11 eight candle-power incandescent lamps on the launch, including side lights, bow and stern lights. The "Electra" will be shipped to Chicago within a few days, and a practical test will be made before the World's Fair Commissioners. Judging by the noiseless and satisfactory manner in which the boat performed on its trial trip, there ought to be no trouble in convincing the World's Fair officials of the practicability of electric launches.

### The General Electric Company.

The General Electric Company issues notice that it has authorized the creation of a series of five per cent. gold coupon debenture bonds, not to exceed $10,000,000, payable June 1, 1922, interest payable June and December.

The company offers holders of stocks and receipts the right to subscribe to $4,000,000 in proportion of one $1,000 bond for 85 shares of stock, or equivalent in receipts issued by the New York Guaranty and Indemnity Company and the Old Colony Trust Company, at 95 and accrued interest.

Subscriptions must be filed on or before 12 M., June 7. On every $1,000 bonds $476.46 will be due June 23 and the balance July 22, when bonds will be delivered. The entire issue of $4,000,000 has been underwritten.

The electric lighting of omnibuses is being tried as an experiment in Berlin.

The Rochester, Ind., Electric Light Company has increased its capital stock from $10,500 to $30,000.

The new Thomson-Houston factory on the Saugus River at Lynn, Mass., will be of brick and cost $275,000.

Deputy Sheriff Sell, of Camden, has seized the plant of the Wellwood, N. J., Electric Light Company, on an execution and judgment of George P. Bush, for $489.

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What shall we call a telegram delivered by telephone? Did we hear some one in the back row say, "What's the matter with 'telegram?'"

We present in this issue several papers read at the general meeting of the American Institute of Electrical Engineers held at Chicago this week. A report of the meeting and other papers will appear in our next issue.

The oil lamp and compressed gas are the systems now generally employed in the lighting of passenger coaches on railway trains. A number of the better and faster trains on prominent roads use electricity, either from a primary or secondary source, for this purpose. The oil lamp is dangerous, dirty, hot and unsightly. It is classed by the traveling public in the same category with the deadly car stove, and is decidedly unpopular. The compressed gas systems are many degrees better than oil lamps, but no method of illumination is so satisfactory for this purpose as electricity. The electric lamp is compact, can be worked into artistic designs and possesses one very important advantage—it produces no heat and does not vitiate the limited atmosphere of a passenger car. Nothing adds so much to the pleasure of traveling as well lighted cars, and railroad companies should generally adopt electric lighting as an advertisement, if for no other reason.

In his address in Brooklyn last week Professor Houston points out five features in the progress of electricity which appear to him as quite possible, namely, electricity produced direct from coal, the steam engine entirely replaced by the electric motor, aerial navigation effected, production of light without heat, and the application of electricity to the curing of diseases and the prolongation of life. These are interesting prophecies, and will attract the attention of numerous scientific workers.

It has become apparent that capitalists have increased their faith in electric railway securities, and more especially in the stocks and bonds of those electric railways used as feeders or connections between important lines of steam railways. There is no doubt of the ability of such roads to earn ample dividends. There are many people living in the country in the vicinity of towns so connected who would make use of the accommodation. The people in the towns would also make use of the electric road. Besides this a freight and express service is possible. As between electricity and steam power for such roads, electricity is decidedly the more economical and satisfactory.

The first annual convention of the Canadian Electrical Association will take place at Hamilton, Ont., next week. The formation of this association is the outgrowth of the Montreal convention of the National Electric Light Association. Our Canadian brethren then realized that Canadian electrical interests needed just such an organization for their proper furtherance and development. A few progressive spirits got together and perfected an organization. The first fruits of their labors will be seen in this first convention. There are wonderful possibilities for electrical development in Canada, and the Canadian Electrical Association has an extended and hitherto untilled field to labor in. May the association reach that measure of success to which the progressive spirit which formed it entitles it.

### *IN A HUNDRED YEARS.*

M. Charles Richet, under the heading of "Demography," has been considering in the *Revue Scientifique* what will be the condition of arts and letters 100 years hence. He does not believe that the worship of industry and the development of the democracy stifle art. The author uses "may be" and "perhaps" a great many times and almost admits the futility of prophecies. And as he approaches the domain of science he falls into the following expressions:

"How about science? If, as regards the arts, all prevision is almost valueless, how much more is it for science! More than art, more than politics, science is revolutionary. What we know of nature is almost nothing alongside of what we are ignorant of; so that a new discovery opens an immense horizon, with distant and unforeseen perspectives. The fact of a great invention modifies from top to bottom a whole series of matters we are acquainted with. A technical discovery, like that of the microscope, the thermometer, the electric pile, brings with it an immense amount of scientific progress, beyond what any imagination, however clear and fertile, can dream of.

"Astronomy is likely to make astonishing progress, though that is dependent on the construction of new instruments. Meteorology, it is certain, will make greater progress than astronomy; for meteorology is a science yet in its infancy, and I think by the end of the twentieth century it will be in full maturity.

"In the matter of chemistry, methods of analysis and synthesis much more perfect than the methods of to-day will assuredly be invented in the coming century. Electricity, however, will make the greatest progress. Not only from the industrial point of view, but from the experimental side as well as the mathematical side, electricity will reserve for our descendants colossal surprises."

Although the practical mind may regard these attempts to penetrate the future as idle and useless, yet we must admit that M. Richet has a selective and appreciative comprehension when he sets electricity at the head of the progressive sciences. And we who toil in the electrical field must have the same and a greater faith in its future; else our work will be heartless and incomplete. "*Laboremus! Laboremus!* Such is my last and precise conclusion."

### *DR. ADAMS' ELECTRIC EXPRESS.*

Dr. Wellington Adams, like his namesake the Duke, appears to be a gentleman to whom immense undertakings are congenial. He has evolved a good big one in his Chicago and St. Louis Electric Railway scheme. His exposition of his ideas before the New York Electric Club left an appreciative audience in the state of mind which follows a conjurer's explanation of a difficult trick, as Professor Forbes expressed it. The discussion which followed the lecture was meagre owing to the lack of details regarding Dr. Adams' electric motor, which he said he could not divulge for patent reasons. It would have been extremely interesting to have had these details and to have heard such eminent authorities as Professor Forbes and Mr. O. T. Crosby discuss them. Dr. Adams presented several ingenious devices, his method of suspending the trolley wire being notably so and capable, probably, of general adaptation.

It seemed to be the prevailing opinion that the construction of such a road in six months is practically impossible. And yet they have a way of doing things in the West when they start out to do them.

Dr. Adams stated that 30,000,000 visitors were expected at the Fair, and that he counted on 3,000,000 of them riding to St. Louis and back on his road out of curiosity. Let's see. The Fair will last six months. This means that Dr. Adams will have to carry over 16,500 passengers per day. His cars hold 40 passengers each. He will need a rolling stock equipment of over 400 cars. According to the Doctor's figures, the through passenger traffic between Chicago and St. Louis over all the existing steam roads amounts to but 1,200 per day. Would the Doctor's railway be a sufficiently big curiosity to increase the passenger traffic from 1,200 to 16,500 per day?

This element of time is a troublesome thing. The Thomson Houston Electric Company has recently contracted with the Baltimore and Ohio Railroad to furnish three electric locomotives and they require a year's time to fill the order in.

Dr. Adams says that the advocates of big schemes are known as cranks and that he is proud to be known as a crank. We have remarked before in these columns that it is the cranks which make the world go. Dr. Adams is a daring projector, an enthusiastic believer in himself and an earnest advocate of his purpose. The lack of important details of this novel scheme permits the skepticism of practical men.

### *STORED ELECTRICITY.*

"There is a vast amount of electrical lore shelved in work shops and jotted in note books."

This sentence is from the address on "Sparking and Flashing of Dynamos," delivered before the Chicago Electrical Association by Mr. F. R. McBerty, and published in the ELECTRICAL REVIEW for May 28, 1892. True words they are, too. And admitting their truth brings us to inquire to what extent should an inventor allow personal and commercial considerations to hold back in secret what would be of benefit to the world and to the art or science which he represents, and which gives him his livelihood? Certainly, an inventor's first duty is to himself, and every inventor gives to the world, to a limited extent, whatever his work produces—provided that work is covered by a patent. But there is much more involved in this question than the divulging of principles or great discoveries. No one expects an inventor or experimenter to hurt himself to that extent. It is the thousand little details of shop and machine practice, kinks, short cuts and labor-saving ideas which many less experienced workers crave, and which can only be acquired by years of practical work.

Electrical workers are as busy as bees, and it is often this reason rather than a lack of interest in the matter which prevents an inventor from telling much that would be helpful to others. The electrical press has done much in ferreting out such information as this, but it is like getting a political leader to name the candidates to persuade an electrician to write up his experiences.

# CORRESPONDENCE.

## OUR SAN FRANCISCO LETTER.

**Highland Springs, Cal.,** now has telephonic connection. It is the first direct communication Lake County has had with the outside world.

The **Thomson-Houston Company,** owing to increasing business, has been obliged to secure more room, and has taken the lower floor of the apartments now occupied, 15 First street.

**Charles J. Thomas** asks for $25,470 for the maintenance of the fire alarm and police telegraph department for the next fiscal year. This is more than the city has paid heretofore.

The **Electric Light Plant** at Haywards, Cal., was recently damaged by fire. The engine and switchboard were destroyed and in consequence the town will be in darkness for some time.

**Dr. Thomas Addison,** general agent for the Thomson-Houston Company, has returned to this city after making a flying business trip East.

**R. B. Elder** has severed his connection with the Pacific Electrical Storage Company and is now in business for himself under the name of the Pacific Electric Contracting Company.

The **Oakland Gas, Light and Heat Company** have secured the contract for the lighting of that city by electricity and gas for the next fiscal year.

The **Los Angeles Electric Light Company** has recently purchased an alternator capable of supplying 2,500 sixteen candle-power lamps. It is said to be the largest west of the Rocky Mountains.

**Bakersfield, Cal.,** is soon to have an incandescent lighting plant. The Electric Light and Gas Company, of that town, have contracted for two generators capable of supplying 1,000 lights.

**Work is Progressing** at a rapid rate on the Telegraph avenue electric road in Oakland. The power house is completed and a greater part of the track laid.

**Incorporated.**—Nicaragua Water, Irrigation and Electric Company, of San Francisco; capital stock, $250,000. Directors, A. P. Bacon, G. C. Jewell, W. C. Quinby, W. F. Russell and J. I. Jewell.

At the **Next Regular Meeting** of the California Electrical Society, June 6, Samuel H. Taylor will read a paper entitled: "A Few Thoughts on the Present Electrical Situation."

**San Francisco** is to have another electric light company. It is to be owned by the Westinghouse Company, James G. Fair and an English syndicate. The company is to be incorporated with a capital stock of $1,000,000.

The **San Francisco and San Mateo Electric** Railway will soon reach the ferries. The company is now engaged in laying a third rail on each side of the lines of the Omnibus Cable Company, on East street. The present terminus of the road is at Steuart and Market streets.

The **Metropolitan Railway Company** and the North Beach and Mission street Railroad Company have filed answers to the complaints in behalf of the people by Attorney-General Hart enjoining them from erecting poles within certain restricted territory. Their principal defense is that the trolley is already in use within this territory, and, therefore, the Supervisors have no right to prohibit them while others have been permitted to use the system.

**Theodore Meetz,** at a recent meeting of the Board of Trustees, of the city of Alameda, applied for a franchise for an electric railway. This road is to run from Fruit Vale Station (on the Southern Pacific road), Oakland, down Harrison avenue into Alameda. If the franchise is granted this individual will hold all the valuable outlets to Alameda. Mr. Meetz has maintained a one-horse car line between Alameda and Oakland for the last 10 years, and for the last three has been promising the public that he would adopt electricity as a motor power, but he has not done so. The public is thoroughly disgusted, and it is hoped his latest application for a franchise will not be granted, as it is believed he has no intention of building an electric road. He claims to be negotiating with a storage battery company East with a view of adopting that system, but to those familiar with the situation it is thought to be a mere role of his to appease public indignation. Oakland, the sister city of Alameda, now has three electric roads in operation, and a number are in the course of construction.

The **Daily Press** of this city, or at least a part of it, seems to be antagonistic to the electric railway. This antagonism has been made manifest in numerous ways. First there was a cry made against granting franchises to the companies who were to construct these roads, and, now that one has been put into successful operation, the press seems to be on the alert for something to criticise in its workings. Recently a car on the San Francisco and San Mateo electric road was lost control of while descending one of the heavy grades, and left the track. Those in charge of the car state the accident was caused by the excitability of the passengers, who, when they noticed the car going at an extra speed, crowded those in charge of the brakes, necessarily hindering them from freely applying same. Accidents of this sort on San Francisco cable cars are numerous, but are not followed by such widespread comment as was this accident. A certain daily in this city, which has appeared to be particularly biased against electric roads, gave vent to its spleen by printing an exaggerated illustration, and by editorial comment. In this editorial, with a characteristic ignorance regarding electrical matters, it suggests that hereafter, in cases of this kind, "the powerful machinery of the car be reversed." The manipulator of this editorial pen should at once apply to the company for a position as "motorneer," as he has evidently missed his calling.

**The Underground System** for electric roads, invented by G. W. McNear, of Oakland, has attracted no little attention here on the Pacific Coast and East. Mr. McNear has had an experimental line constructed near the power house of the Oakland and Berkeley Electric Railway. The correspondent of the ELECTRICAL REVIEW here found the gentleman, and was given an opportunity of examining the road. In this system there is to be a roadbed constructed much like a cable roadbed, the trench being about 15 inches deep. There will be a half-inch slot in which will travel an apparatus resembling the upper part of a cable grip. This will carry a system of copper wheels, whose upper surface will press against a flattened copper wire. This copper wire is placed in the center of a stout strip of rubber. This flattened wire conductor is not placed directly under the slot, but is on one side of it and beneath a protecting beam or contrivance of some sort. The rails, as in the case of the overhead system, complete the circuit. Although this short experimental line apparently works to perfection, still, in the minds of persons familiar with the many attempts made at perfecting a system of this kind, there seems to be doubt as to whether this will not be subject to the same difficulties experienced with other conduit systems when put into actual service.

**Prof. J. P. Barrett,** city electrician of Chicago, and chief of the Electrical Department of the World's Fair, visited this city last week. He was found at his stopping place, the Palace Hotel, by the ELECTRICAL REVIEW correspondent. "What do I expect to find in California for the Electrical Department of the World's Fair? Well, I expect to find a number of things," he replied, in answer to a question. "There has been space set aside for California and we mean to fill it. World's Fair Commissioner M. H. deYoung, of this city, and my friend F. C. Stover, of the Gamewell Company, have promised to aid me in collecting odds and ends which may be of interest. California, as yet, has not developed many manufacturing industries in this special line, but there are a great many electrical patents issued to inhabitants of the State, and it is, therefore, probable that quite an interesting exhibit may be secured. Electricity has been made to play an important part in the great mining industry of this State, and many novelties may be found in the shape of ore separators, etc." Professor Barrett was very enthusiastic regarding the World's Fair and especially the division over which he presides. He states that Edison will make the effort of his life and that others are fully as enthusiastic. Thirty one years ago Professor Barrett visited this city, and to say he was surprised at the great changes wrought in this length of time, would be but feebly expressing it. His wife accompanied him.

J. R. K.

San Francisco, June 1.

## OUR BOSTON LETTER.

**The New England Telephone Company's** net output of telephones during the present month was 6,132, said to be the largest on record.

**The Haverhill and Amesbury, Mass., Electric Railway** will have its branch road to Salisbury Beach finished and equipped within a week.

**Stamford, Conn., Electric Light Company,** recently organized, has purchased from the New England office of the Westinghouse Electric Company an 800 light incandescent (alternating) machine.

**Mr. F. W. Ashcroft,** special agent for the Edison Company's Eastern District offices, during the past year, has accepted an influential position in the Boston offices of the Mather Electric Company.

**The Corliss Engine Company,** Providence, R. I., has furnished two 72-inch vertical tubular "water leg" boilers (its own make) to the Hathaway Manufacturing Corporation, New Bedford, Mass.

**Dr. F. A. C. Perrine,** formerly connected with the great wire manufacturing industry of the John A. Roebling's Sons Company, has become identified with the Germania Electric Company as its treasurer.

**Mr. Henry Clarkson Scott,** president of the Wichita, Kan., Electric Light Company, and prominently identified with other electrical industries in Kansas and Texas, was among the prominent arrivals in town this week.

**Mr. Morris W. Mead,** superintendent Bureau of Electricity, Pittsburgh, Pa., and also president of the Electric Club of that city, has been a welcome visitor among the electrical industries of this section during the week.

**The Eastern Electric Supply and Construction Company,** this city, has leased the lower floor and basement of the building at the southeast corner of Franklin and Arch streets; and already the removal of stock has begun.

**Messrs. Parker, Field & Mitchell,** No. 23 Main street, Cambridgeport, Mass., have taken charge of the New England agency for the Goubert water-tube feed-water heater. The company are sole builders of the "Boston" hoisting and mining engines.

**The Thomson-Houston Bureau of Information,** this city, is about to issue a circular announcing for the first time that, "the General Electric Company is to furnish electric railway equipment heretofore manufactured by the Edison General Electric Company and Thomson-Houston Electric Company."

**The Germania Electric Company,** this city, will remove its offices from the Exchange Building to No. 620 Atlantic avenue (Hathaway Building) the first week in June. This company has secured an order to install an insolated plant in one of the mills at Lebanon, N. H. The new "Germania" dynamo will form a part of the plant's equipment.

**The Uxbridge and Northbridge Electric Light Company,** Whitingville, Mass., has purchased from the New England department of the Westinghouse Electric Company, an additional 60 arc light (alternating current) machine. The company first named has been using the Westinghouse alternating arc-light system for more than two years, and are so well pleased with the lights that the increase above mentioned was voluntarily made.

W. I. B.

Boston, June 4.

## OUR CHICAGO LETTER.

**C. A. Daigh,** of the National Electric Manufacturing Company, Eau Claire, Wis., is in the city.

**The Central Electric Company** are having a large call for Okonite wire, for which they are Western agents, and among the many orders received recently is one for 250,000 feet.

**Walter C. McKinlock,** of the Enterprise Electric Company, returned from a business trip West as far as Denver, Colo., and reports having secured several very large orders.

**Clark & Marshall** have secured a more desirable office and are now located at 413 "The Rookery," where they carry a full line of electrical specialties, and are prepared to fill all orders promptly.

**F. W. Cushing,** general Western agent for Day's Kerite wires, reports the sales for the month of May double the amount of any previous month this year, and prospects for increased trade very flattering. Mr. Cushing is establishing live agencies throughout the West in all principal cities.

**Paul W. Bossart** has been appointed special agent of the National Electric Manufacturing Company, with headquarters in this city. Mr. Bossart is well known to the electrical fraternity, and until recently had charge of the Western agency of the Short Electric Railway Company at Denver, Colo.

**G. E. Horn & Company** have lately placed upon the market a new electric bell which is nicely encased in a wooden box, which makes it very attractive. The bell is very sensitive, and has been tested from one to 12 cells without re-adjustment. Mr. Horn reports an order for 500 received from the first sample sent out.

**Mr. Geo. Cutter** will lecture before the Chicago Electrical Association, June 14, on "Thomson's Induction Experiments." He has lately prepared apparatus for repeating many of the illustrations devised by Prof. Elihu Thomson and he will also show some novel experiments in the same line. The lecture will be held at Atheneum Hall, 26 Van Buren street, and the Association has extended an invitation to all interested in this line.

**George Cutter** has just returned from Champaign, where he lectured at the University of Illinois on "Electric Power Transmission." An audience of 250 listened to his interesting account of the new developments in this line, particularly those of transmission by multiphase currents. The lecture was illustrated with the aid of a special apparatus and the remarkable induction experiments devised by Professor Thomson were repeated by Mr. Cutter.

**The Detroit Electrical Works** has just received an order from the Jacksonville Street Railway Company, Jacksonville, Ill., for three additional 30 horse-power motors for their road. In January last they were given an order for three, also the Thomson-Houston Company an order for three 30 horse-power motors, with the understanding that which ever gave the best satisfaction would get the increase. The placing of the second order with the Detroit people is evidence that they were very much pleased with the apparatus furnished by this well known firm.

**The Duplex Electric Company,** of Corry, Pa., find the demand for their well-known goods so great that they are obliged to run their factory night and day in order to supply the trade, and yet are way behind on their orders. They have increased their capital stock to $50,000 and will soon build additions to their factory which will give them three or four times their present capacity, which will enable them to fill all orders promptly. Mr. Randolph, their Western agent, has just returned from the factory after an absence from the city of five days, and predicts a very successful season for this company during the present year.

M. J. B.

Chicago, June 4.

## PERSONAL.

Professor George Forbes, who has been visiting this country for about two months, expects to return to England this week.

Mr. J. P. Barrett, chief of the World's Fair Department of Electricity is visiting the Pacific Coast looking up electrical exhibits.

Mr. Horatio A. Foster, special agent of the electrical division of the Census Bureau, has returned to New York city after a six months' trip through the western part of New York State.

Lieut. F. W. Toppan, U. S. N., a well known member of the New York Electric Club, who is now sojourning in England, was present at the Jackson-Slavin fight in London last week.

Mr. William Steinway, president of the New York Rapid Transit Commission, sailed for Europe last week. He expects to be away three months and will study the rapid transit systems of all the large European cities.

President W. H. McKinlock, of the Central Electric Company, was a visitor in New York city the past week, enjoying the hot weather and thrilling his numerous friends of the metropolis with accounts of his terrible earthquake experience on the occasion of his recent visit to San Francisco.

Mr. Henry W. Goode has been elected second vice-president of the Northwest Thomson-Houston Electric Company, of St. Paul, of which Mr. H. M. Byllesby is the able and enterprising president. Mr. Goode is a successful and capable electrical worker, and will be a strong addition to Mr. Byllesby's staff.

Mr. Wiley W. Smith, of the Missouri and Kansas Telephone Company, Kansas City, Mo., passed through New York last week on his return to the West from Boston. Mr. Smith stopped long enough in New York to commune with the leaders of thought in telephonic circles and pay his respects to the ELECTRICAL REVIEW.

Mr. Joel C. Clark, for many years treasurer of the New York and New Jersey Telephone Company, but who, for the past two years, has been in very poor health, is receiving many warm greetings from his friends who are pleased to meet him again and note his recovery. Mr. Clark is one of the pioneers in the telephone business and numbers his friends by the score, all of whom, with the REVIEW, will be pleased to know that he is restored to health.

## American Institute of Electrical Engineers.

(Special to the ELECTRICAL REVIEW.)

CHICAGO, June 6.—The first session of the general meeting of the American Institute of Electrical Engineers was called to order at 10:45 this morning, by President Frank J. Sprague. Vice-President Thomas D. Lockwood was elected presiding officer. There was a good attendance, about 50 answering the roll call. The first paper presented was one on experiments with alternating currents by Dr. Louis Duncan. Among those in attendance are Dr. Elisha Gray, Charles Wirt, Herbert Laws Webb, H. Ward Leonard, Carl Hering and Charles A. Benton.

M. J. B.

## Telephonic News

*** Work has been commenced on the new telephone exchange at Atlanta, Ga.

*** Telephones first went into commercial use in Buffalo, N. Y., on February 1, 1879.

*** The telephone exchange at Winona, Minn., will be rebuilt and metallic circuits installed.

*** The Sunset Telephone and Telegraph Company has secured rights of way through Oakland, Cal.

*** A new telephone line between Halifax and Yarmouth, N. S., will be completed by the middle of August.

*** The New England Telephone Company is extending its line from Livermore, Me., through several villages to Farmington, giving tourists to Rangeley Lakes direct communication with the cities.

*** When the stockholders of the Bell Telephone Company, of Philadelphia, hold their annual meeting in July, they will vote upon a proposition to increase the capital of the corporation from $600,000 to $1,000,000. It is the intention of the company to make additions to the underground system, and the additional money will be needed for that purpose.

*** Chris Cory, the station agent and telegraph operator of the Chicago and Erie Railway Company at Decliffe, O., was run over by a car the night of May 31. Both his legs were cut off and his body was horribly mutilated. After being injured there was no one to send a message for help, and Cory had the trainmen hold him up to the instrument while he telegraphed for a physician and also to headquarters. The poor fellow died, leaving a wife and two children.

## Railway Train Lighting.

READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, ILL., JUNE 6 TO 8, 1892, BY A. H. BAUER.

The first successful system of railway train lighting is that invented by Houghton, and adopted by the London, Brighton and South Coast Railway of England, in 1881–2. Since then the many improvements suggested by other inventors have made it almost automatic.

The system consists of a Brush dynamo carried inside the baggage compartment, and directly connected by link belting to pulleys on the axle of the car. Attached to the dynamo is a ball governor, rotating vertically, whose office is as follows:

1st. To control the movement of a switch which, when the speed and therefore the electromotive force of the dynamo reaches a predetermined value closes the circuit, and also opens it again when the electromotive force approximates that of the secondary battery.

2d. The adjustment of a resistance which maintains the current constant, and

3d. To shift the position of the brushes as the neutral point is changed by the varying speed of the armature.

But one set of brushes is used, carried in rectangular holders, at right angles to the commutator and always in contact with it.

When the rotation of the armature is reversed by a change of direction of the train, the brushes are carried forward or backward by the friction on the commutator and a connection with the governor until the quadrant passes but a fraction beyond the vertical, when it is drawn to the proper position by a spring, the action being similar to that of the snap switch. Limiting stops are provided to prevent the quadrant going too far.

The same movement of the quadrant also changes the position of a switch controlling the connection of the field coils and, therefore, the polarity of the dynamo. It therefore follows that the current is always in the same direction, no matter which direction the armature may rotate. One set of accumulators, consisting of 25 cells, is provided for each train, and placed in the baggage compartment. The maximum number of lamps in a train is 70, of 10 candle-power each, at 50 volts.

No attendant is necessary, but at certain stations on the line an examination of the plant is made and required repairs attended to. I am informed the system is so reliable that since the year 1888 but two failures have occurred.

It will be noted that the key of this system is the convenience with which the connection between the armature pulley and that on the axle can be made.

Throughout Europe the rigid wheel base is universally employed under railway cars; consequently, by setting the dynamo across the car, the armature shaft will always be parallel with the axle, and the connecting belt runs in practically the same plane.

In this country the bogie truck is exclusively used. Several attempts have been made to drive dynamos by connections with the axle of bogie trucks. All, however, have failed, for the reason that no provision was made for maintaining the armature shaft and axle parallel at all angles of the truck, and because sand, dirt, etc., gathered by a moving truck will soon destroy any mechanism that may be used for the purpose under the car. The problem, however, has not been abandoned, and I am in hopes that within a very short time a solution will be found.

Numerous propositions have been made to use primary batteries for car lighting, but I am not informed of a successful installation of that character.

Secondary or storage batteries have been more or less employed for the purpose, with varying success. The first attempt in this direction was made in 1887–8 on two Pullman limited trains, of six cars each.

Each car was equipped with 30 cells of battery, having a capacity of 150 ampere hours, and weighing 50 pounds per cell, or 1,500 pounds per car. Duplicate sets were kept charged at each end of the line, and on arrival of the train, exchanged for those that had been exhausted while on the road. The average number of lamps per car was 26, of 16 candle power, at 60 volts, or a total of 156 in the train. After 60 days' trial, it was clearly demonstrated that, under existing conditions, the system could not be made successful, and it was abandoned.

The reasons for its failure were—First, that the capacity of the battery was insufficient to maintain the number of lamps required for the proper lighting of Pullman cars on long runs.

For example, the current required for twenty-six 60 volt, .8 ampere lamps, is about 20 amperes. Therefore, $\frac{150}{20} = 7\frac{1}{2}$ hours, that is to say, 1,500 pounds of battery was able to maintain 26 lamps but $7\frac{1}{2}$ hours. These trains leave east-bound at 5 P. M., but the light is required at 4 P. M. for inspection, receiving passengers, etc. Consequently the batteries would become exhausted at 11 P. M.; in fact, it would be earlier, as will be explained. Therefore, the oil lamps would have to be used when light was required during the remainder of the trip. Westbound the same reasons held good, although not to the same extent, because the train leaves that end in the morning and passengers will, as a rule, after 12 hours' traveling, retire earlier than those going east, leaving at 5 P. M. Consequently less light is required and a certain percentage of the charge is not used.

A second reason was the deterioration of the batteries themselves, which were of the pasted grid type. It was found that the constant agitation of the acid solution in the jars, as well as the unavoidable rough usage to which they were subjected when changing, caused a loss of the paste or active material, proportionately reducing the capacity. In fact, close observation indicated the loss during one handling to be equal, if not more, than that caused by 1,000 miles travel on the car. The paste, when separated from the grid, accumulates in the bottom of the jar, or lodges between the plates, forming a circuit through which the cell is discharged, resulting in the buckling and sulphating of the plates, and the destruction of the positive elements within a short time. This was five years ago. Since then improved methods of manufacture, as well as more intelligent care in handling, has, to a great extent, overcome their objections and thereby increased the life of the battery. It may be asked—why not increase the size and, therefore, the capacity of the cell? The reply is—that to properly light a train of six Pullman cars, for instance between Chicago and Jersey City, with the number and kind of lamps above stated, would require 30 cells, each weighing not less than 100 pounds—a total of 3,000 pounds per car, or 18,000 pounds for a six car train. The expense of handling and changing such a weight would make its use almost prohibitory, for each cell would have to be handled singly. The weight on the car would also be objectionable. Since these experiments were made, car lighting for short distance only, from storage batteries, has been made successful. For the past two years four cars, each equipped with 32 cells of 150 ampere hours capacity and 26 sixteen candle-power 60 volt lamps have been running between Chicago and Cincinnati, and Chicago and Indianapolis. Two of these cars are charged every day at Chicago for about nine hours with sufficient current for a round trip. The batteries, however, are not changed; the cars are always placed on the same side track to which wires from the dynamo are led, and the charging is done without removing them. The average length of time the light is required during a round trip is six hours; the cars leave each end of the line at 8 and 9 P. M., respectively. Repairs are made by removing the defective cell and substituting another if necessary.

The cost of repairs and renewals of all kinds from September, 1891, to January, 1892, inclusive, per month, was as follows:

| | |
|---|---|
| September, 1891 | $ 36 44 |
| October, 1891 | 108 82 |
| November, 1891 | 51 24 |
| December, 1891 | 79 21 |
| January, 1892 | 38 31 |
| Total | $314 02 |

which, divided by four, is $78.50 per car per month, or $2.61 per car per day, and this divided by 26 gives 10 cents as the cost per lamp per day. As the engine and boiler are used for furnishing power for other purposes while running the charging dynamo, it is difficult to get the cost of the power for charging these batteries, that factor, therefore, is not included in the above statement.

In January, 1888, a solution of the problem of lighting six-car trains for long distances was sought for in another direction. Two trains running between Jersey City and Jacksonville, Fla., a distance of 1,100 miles, were selected for the experiment. At first an attempt was made to utilize the power of the axle, but for reasons already stated did not prove successful.

The next step was the substitution of a vertical single stroke engine, located in the baggage car, for the axle connection. This engine was belted to the dynamo, and was supplied with steam from the locomotive boiler.

While this plan seemed to be a step in the right direction, it still had its objections, due to the fact that the upward and downward movement of the driving rod acted in the same manner as would a heavy blow on the car body, so that the latter would vibrate in unison with the stroke of the engine.

After a few trials, the vertical engine was removed and a three-cylinder reciprocating engine, with three-inch cylinders and four-inch stroke, was substituted. It was connected direct by a flexible coupling to a 75 volt 60 ampere dynamo of the ordinary open frame type, and both run at 1,000 revolutions per minute.

The working of this combination clearly demonstrated that a solution of the problem was attainable, and it was now possible to guarantee a fairly successful lighting of the two trains. A fault soon developed, which could not be anticipated. It is well known that all railway trains, while running, gather more or less dust and dirt, but it was not known until train lighting was attempted that this dust and dirt contain certain quantities of carbon and metal which adhere to armature and field wires, and being conductive form short circuits. So frequently did this occur, that it became necessary to carry an extra armature with each plant, and make changes while the train was in motion. Later in the year these dynamos were removed and the Eickemeyer installed. The Eickemeyer dynamo seems to be perfectly adapted for train lighting. As both the armature and field coils are protected by the iron of the machine, the dust and dirt does not reach the wire, except in small quantities, and by removing it every six months, when the car is shopped for repairs, short circuits have been prevented. Its strong construction is such that it will successfully withstand the general rough usage to which machinery of this character is subjected to on railway trains.

The system which has been used for the past five years on all Pullman trains, consists of a Brotherhood three cylinder engine and Eickemeyer dynamo, bolted to a cast-iron bed-plate, and located in the forward end of the baggage car, occupying an enclosed space of six feet six inches by three feet three inches. The engine and dynamo are connected by a flexible coupling which allows for the irregularity should they not be in perfect line. A two gallon sight feed pressure lubricator bolted to the end of the car, furnishes oil to all wearing parts of the engine. The average consumption of oil is about one gallon every 20 hours of actual running of the engine.

Steam is taken from the locomotive boiler, a tap being made at the dome, the pipe passing under the tender and car, between which a flexible rubber hose makes connection. It has been found that with 1¼ inch pipe between the boiler-head and car, there is a loss of 15 pounds pressure due to friction and condensation; therefore, to run the engine with 50 pounds, requires 65 pounds at the supply pipe on the locomotive. With 50 pounds pressure, the dynamo will, at 900 revolutions, generate 80 amperes, at 72 volts, when all the lamps and batteries in a six-car train are in circuit, and 50 to 75 amperes, at 80 to 85 volts, at the same speed, when the batteries alone are connected, depending on the counter electromotive force of the batteries.

On the side of the car is placed an automatic switch, which will break the circuit when the electromotive force of the dynamo equals that of the batteries. A voltmeter and ammeter are kept constantly in circuit while the plant is in operation. A tachometer, belted to the armature shaft, is also provided for noting the speed of the engine and dynamo. This plant is enclosed by a tongue-and groove partition surmounted by a wire screen.

The system of wiring adopted is the equipotential, in which the pressure is practically equal at each lamp and battery. One wire leads from the positive pole of the dynamo to the rear end of the rear car, where it is coupled to a second that returns to the baggage car—but not to the dynamo—being tapped, however, by the positive pole of each battery and one side of each lamp. A third wire leads from the negative pole of the dynamo to the rear end of the rear car, where it ends. This third wire is tapped to the negative pole of each battery and the remaining side of each lamp.

All the batteries and lamps are, therefore, in multiple arc. Double pole, fusible cut-outs are placed in each circuit, and, with the switches, are located in the closets of each car. The wires are always placed on the roof of a car. For this purpose, whitewood moulding, thickly coated with asphalt paint, is nailed from end to end as near the center as possible, usually one and three-quarter inches from the edge of the smoke-jack if the car is equipped with center oil lamps, and from 6 to 24 inches when gas lamps are applied. Branch mouldings extend to all points on the roof through which it is desired to run wires to the lamps, switches, etc., inside the car. For instance, the drops to the center lamps in the body of the car pass directly through the center of the roof into the air chamber of the oil lamp, from where they are suitably connected. Those leading to the switches, cut-outs and batteries pass through the panels between the ventilators and into the closets where the switches are located, the batteries continuing on through the floor to the boxes under the car. After being run in the moulding, the wires are covered with wooden capping and the whole tinned over, practically forming part of the roof. The grooves in the moulding are made of such size as to hold the wire rigidly, so that its movement or abrasion is impossible. Wire so applied has, after five years' service, shown no deterioration whatever, and is apparently serviceable for at least five years more. As the tin covering of the moulding is cut and worn away by cinders and the action of the elements, it is found necessary to renew the moulding about once a year. The sizes of wire used are all of B. & S. gauge, and consist of No. 2 for those leading from the dynamo, Nos. 6 and 10 for the lamp mains and No. 14 for the lamp drops. The connection between cars is made by bringing the wires from the roof through the hood to the inside of the vestibule, where they terminate in square brass tubing called connectors, which are permanently attached to the vestibule frame. The connection between these connectors is made with three conductor flexible cables, each conductor of No. 6 gauge. To the ends of each conductor, brass springs are attached which fit closely inside the tubing, giving about eight square inches contact. If cleaned occasionally this connection will carry 100 amperes without sensibly heating. As the connectors are placed horizontally it is evident that should the train from any cause be parted, the connection will be severed without damage to any part of the system, except to throw the load off the engine and cause it to race. Should this occur, which, in fact, is very seldom, the attendant is at hand to cut off steam and stop it until the connector can be replaced. With a No. 2 wire the average fall of potential in a six car train is nine volts.

When the batteries alone are in circuit, the electromotive force of the dynamo will be from 67 to 83 volts, which, minus the loss, will overcome the counter electromotive forces of the batteries, viz., 57.6 to 73.6 volts. When both lamps and batteries are in circuit the external resistance is, of course, reduced and the electromotive force of the dynamo falls in proportion, and that at the lamps will be from 60 to 66 volts.

It is unnecessary to use a resistance in the lamp circuit, as when the lamps are first turned on, the electromotive force being, say, 66, a greater candle-power is had just at the time when most needed, which, however, gradually falls and ordinarily reaches 60 to 61 volts in from two to four hours, depending upon the amount of charge in the batteries. It is true that this is at the expense of the life of the lamp, but as the handling of the switches is done by the porters and conductors, the use of rheostats

(Continued on page 210.)

## LITERARY.

The *New England Magazine* for June shows again how this popular periodical is broadening out to meet the demands of readers in every section of the country. It opens with a clever and comprehensive article on "Art in Chicago," by Lucy B. Monroe, a well known Chicago critic. This is the first time full justice has been done to the real art movement in the Western metropolis.

"American Telegraphy; Systems, Apparatus, Operation." By William Maver, Jr. 563 pages, 450 illustrations. J. H. Bunnell & Company, New York. Price, $5.

The author of this very complete work is the electrician of the Consolidated Telegraph and Electrical Subway Company, of New York, ex-electrician of the Baltimore and Ohio Telegraph Company, and a member of the American Institute of Electrical Engineers. He is, therefore, quite competent to deal with the subject in question. Mr. Maver has attempted to supply a comprehensive account of the systems of telegraphy now in use in America. Such an account would naturally include sources of electromotive force employed, line construction, line and apparatus testing, instruments and appliances; and these subjects have been dwelt upon at some length. The question is treated from a practical standpoint, and the book has been written in a manner intended to be clear to novices in electrical matters, more especially those who are directly engaged in practical telegraphic work. The author has wisely confined reference almost entirely to those systems and methods which are in actual use in this country, and has thus been able to treat each system described in detail within the limits of one volume. The diagrams and illustrations are, many of them, of original design, and those illustrative of the theory of the quadruplex are especially valuable to practical telegraphers.

In writing of early systems of telegraphy, Mr. Maver relates the following: "A system of telegraphy known as 'Washington's Telegraph' was at one time employed in this country. It was, presumably, so-called because of the fact that it was one among many similar telegraph systems used during the war of Independence in this country. The apparatus used in the Washington telegraph system was easy of construction, and it must be admitted somewhat crude. It consisted of a portable mast on the top of which was placed a tub or barrel, also on one side of the post a movable flag was placed, and on the other side near the top a basket, which was suspended from a bracket or nail. By interchanging the position of the flag, the barrel and the basket, and by moving the flag up and down, various signals could be sent, about 60 different signals in all."

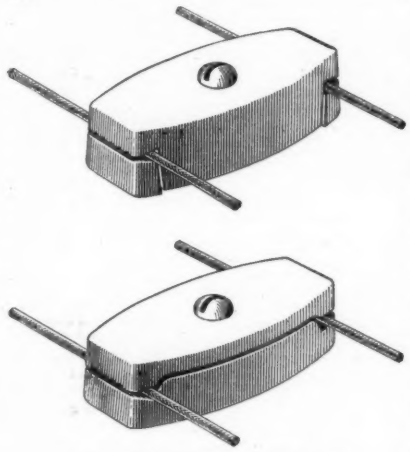
This work is ably written and satisfactorily printed and bound. It is a valuable addition to the literature on the telegraph, and should deservedly reach a large sale. The book will be forwarded on receipt of price by the ELECTRICAL REVIEW, 13 Park Row, New York.

The valuable and timely article "Flowers for June Weddings," by H. H. Battles, gives a peculiar charm to the June *Ladies' Home Journal*. The publishers of this popular magazine, ever on the alert for new features, present in this number the first of a series of articles, "Literary Women in Their Homes." The series opens with a delightful sketch, with photograph, of the home life and personality of Augusta Evans Wilson, the author of "Beulah."

The most cursory glance at the eleventh annual issue of J. A. Berly's *Universal Electrical Directory* shows the rapid increase of all electrical industries and the numerous subsidiary trades in connection therewith. It is a work quite international in its scope, and must entail vast labor and expense to keep it up to date. It may be noticed that there is an increase of 65 pages over the 1891 edition, and the 1892 book actually contains 200 pages of new matter. The list of central electric lighting stations in Great Britain, arranged in map form, is a strong feature, the information therein given being most useful for reference. A directory can never be said to be absolutely correct, but a work which contains nearly 75,000 entries, and which in scope covers the whole civilized world, and can yet boast of having not more than two per cent. of errors in one year's work, must be held to come very near the point of absolute correctness, and this, it may be mentioned, is the position held by this standard electrical trades' directory. Berly's *Universal Electrical Directory* must be indispensable alike to all those who are engaged as electrical and mechanical engineers, manufacturers, traders and contractors.

### A Two Wire Porcelain Cleat.

The Security Insulator Company, of 136 Liberty street, New York, realizing the need of a two wire porcelain cleat that would be cheap, practical and effective, have perfected what they call the "Security" cleat. It is really what its name implies, a secure cleat, inasmuch as the wires are held securely in their places without kinking the wire or injuring the insulation. Like the "Security" insulator, wires of different sizes can be used with the same result, and that an eminently satisfactory one. The accompanying cut shows both front and back views of the cleat and are about one-half the actual size.



A TWO WIRE PORCELAIN CLEAT.

### American Street Railway Association.

The American Street Railway Association has issued the following circular:

The special committee appointed by the American Street Railway Association for the purpose of securing as commendable an exhibit as possible of all that pertains to the street railway business at the forthcoming Columbian Exposition at Chicago desires to urge upon you the importance and necessity of making application at once for such space as you will need to make a proper exhibit of your manufactures.

This Association has secured 50,000 square feet, and the allotments of space as to desirability will be made in the order in which applications are received. Unlike any other World's Fair, the management of the Columbian Exposition will arrange the exhibits regardless of nationality in departments, each comprising all that relates to a particular industry or subject. All, therefore, that relates to transportation will be in one building, and that devoted to street railways will all be gathered together in one section of the building.

The Exposition will make no charge whatever for space. It will be necessary in estimating the amount of space required, to state just the number of square feet needed for the exhibit independent of aisle room. A limited amount of power will be supplied without charge. Exhibits will begin to be received as early as November 1, 1892, and no article will be admitted after April 10, 1893. Complete rules, covering the entire subject, will be sent on application to Mr. Willard A. Smith, chief of the Department of Transportation of the World's Columbian Exposition, Chicago, Ill.

Mr. John B. Parsons, vice-president and general manager of the West Chicago Street Railroad Company, has kindly consented to serve the Association as its sub-committee, to advise with Mr. Smith in reference to the exhibit under the auspices of this Association. All applications for space and information in regard to the exhibit should be made to Mr. Willard A. Smith, chief of the Department of Transportation, for which purpose an envelope, duly addressed, is enclosed.

The committee desires specially, as stated in the outset of this letter, to impress upon you the necessity for immediate action, as hereinbefore set forth, should you desire to be represented by an exhibit at the World's Columbian Exposition.

### Brush Company Wants to Withdraw.

A peculiar case has been taken to the United States Circuit Court of Appeals by the Brush Electric Company, the appeal being from an order denying a motion to dismiss an action.

The original suit was brought by the Brush Electric Company, the California Electric Light Company and the San Jose Electric Light and Power Company against the Electric Improvement Company, of San Jose, and was a suit for an injunction to restrain the defendant from infringing certain patents on arc lights held by the Brush Company, and in which the other two plaintiffs held interests.

The Brush Company asked that the case be dismissed as far as it was concerned, the suit being brought without its knowledge or consent. Judge Hawley held, however, that the Brush Company was bound to assist in maintaining the rights of those to whom it had assigned interests in its patents. It is this order denying permission to withdraw that the Brush Company appeals from.

### Powerful Turbines for Niagara.

The immense new pulp and paper plant of the Cliff Paper Company, at Niagara Falls, is to be supplied with late new designs of the horizontal shaft double discharge James Leffel wheels, built by James Leffel & Company, Springfield, Ohio. The contract for this work was signed by the Cliff Paper Company and James Leffel & Company, on May 13, after the Cliff Company had made a full and careful investigation of the merits of various wheels presented during the past year for their consideration. Each of these turbines is to be 1,100 horsepower capacity. These wheels will connect directly to the pulp grinder shafts at each end of the wheel shafts, without belts or gearing.

This water wheel company has celebrated its thirtieth year of continuous business in this line of work. They have added many improvements to their James Leffel wheel in the past two years; and have designed a large number of new styles, incorporating in them the best ideas of their large experience. The manufacturing plant of this company has also been recently greatly extended, and various pieces of new, improved and heavy machinery added; all adapted to the heavy water wheel work they are now manufacturing. They shipped some time since one James Leffel wheel and casing weighing 45 tons, and also filled one order for 19 large wheels for one pulp and paper company.

### Use Graphite.

A correspondent in the *American Machinist* says: If engineers, machinists and millwrights in general and pipe fitters in particular knew of the good qualities of graphite, I dare say there would be 10 times the demand for it. Its lubricating qualities are questioned only by the impractical and it is this quality alone that sounds its keynote, so to speak. Let me describe a few of what I consider its most important uses. As above stated, its primary object is lubrication and it is to this fact we must credit good pipe joints and cool bearings. In making pipe cement (or as I would term it, pipe smear), it is not necessary to use the best oil or grease, as it is the graphite, and not the body in which it is suspended, that makes the mixture valuable and the joint perfect. I use the drippings from line shaft bearings, caught in the ordinary way and mix it with the best Ticonderoga flake graphite so that it can be applied with an ordinary sash tool.

During the past three years I have used about 15 or 20 pounds of dry Ticonderoga flake graphite for pipe joints, cylinder heads, piston rod packing, etc.

Bolts smeared with graphite, mixed as above, I have unscrewed after having been in the dampest places for upwards of two years, or more, proving the anti-rusting qualities of graphite. To cool hot bearings put it on as thick as it will mix with oil.

Almost any oil or grease will answer but don't use poor graphite.

## TELEGRAPHIC

.... The Western Union Telegraph Company is stringing a copper wire from Chicago to Minneapolis, *via* Freeport, for the use of the Republican National Convention.

.... Surveyors are at work along the Jefferson branch surveying a pipe line from Bradford, Pa., to Hancock, N. Y. A telegraph line will follow the pipe line.

.... S. A. Bee, for many years Chinese Consul at San Francisco, dropped dead on the street May 26. Colonel Bee went to San Francisco from New York in the early days and engaged in building telegraph lines. He was, at one time, attorney for the Six Chinese Companies. He was 76 years old.

.... A tramp operator wandered into the Western Union office at Decatur, Ill., and after begging his supper, told stories. He told of a method of reading off the wire by using his tongue as a circuit between two wires. He told how he had done this act many times during the war when telegraph instruments were scarce or had been destroyed. He earned his supper.

.... The District Telegraph Company, of Paterson, N. J., which has transacted business for several years in the Western Union office, on Washington street, removed on June 1 to the rooms on the corner of Ellison and Washington streets, recently vacated by the Tax Adjustment Commissioners. Manager William D. Westcott will hereafter devote all his time to the District Company, severing his connection with the Western Union after a service of 24 years.

.... It seem a pity that old Professor Morse could not have lived until last week to enjoy the crowning achievement of his inventive genius, the electric telegraph, says the New York *News*. Deeming, the murderer, was hanged in Melbourne, Australia, at 10 o'clock last Monday morning. Melbourne is on the other side of the earth from us and away down in the Southern Hemisphere. The account of that execution was going out of the morning newspaper offices in New York at four o'clock that morning, six hours before the event occurred, according to time records. The apparent paradox of reading about a man's execution several hours before it occurs is, of course, owing to the difference in diurnal time, but what an amazing achievement! Well might the old professor have exclaimed in the language of the first telegraph sent over his little experimental line between Washington and Baltimore, "What hath God wrought!"

.... William J. Phillips, ex-president of the American District Telegraph Company, and at one time superintendent of the Philadelphia electrical department, died recently while visiting on Long Island. Mr. Phillips was born in New York in 1825, and was a lineal descendant of Sir Thomas Phillips, of Milford Haven, Wales. At the age of 20 he became the associate of Professor Royal E. House, who was perfecting the House telegraph instrument. Two years later Mr. Phillips was general manager of the first office in Philadelphia which used that instrument. In 1854 he secured a contract with the city for the erection of the municipal telegraph, completed in 1856, in which year he was elected superintendent of the electrical department by city councils, which position he held about 30 years. Mr. Phillips introduced the fire alarm telegraph in Baltimore, Washington, Cincinnati, Chicago and San Francisco. He was telegraph director and chief of the Bureau of Telegraphy of the Centennial Exhibition, and was connected with the Franklin Institute and a number of business companies. He was a frequent and successful patentee in the line of electrical apparatus, his improvements being in general use.

* * The Hamilton avenue, Brooklyn, electric trolley line went into operation Monday of this week.

* * An electric railroad connecting Ravenna, Kent, Brady's Lake and Sandy Lake, Ohio, is a possibility.

* * Permission is asked for the construction of an electric railway with underground conductors in Berlin.

* * Manchester, N. H., is to have an electrical club. Prof. G. I. Hopkins of the high school in the city named is interested.

* * The passengers in an electric car ran into a street fight between Chinese Highbinders in San Francisco last week. None of the passengers was hurt.

* * The capital stock of the Detroit Electrical Works, Detroit, Mich., has been reduced from $1,000,000 to $750,000, and all of the latter amount has been paid in.

* * The Freeman-Holland Company, dealers in electric light and power apparatus, 53 State street, Boston, Room 342, owe some $10,000. The company's works, which are at 518 Hanover street, are under attachment.

* * Dynamite has been superseded in Sweden for blasting purposes. Electric wires are introduced into the rock and then heated. The sudden heating of the rock rends it in pieces quietly and effectively, without peril to human life.

* * The syndicate, of which Hon. W. A. Russell, of Lawrence, Mass., is at the head, has completed the purchase of the Garvins Falls property in South Concord, N. H., and Bow, and it is stated that in 60 days the city proper will be supplied with electric power from that plant.

* * The electric railroad people, at Chattanooga, Tenn., contemplate laying 36 miles of new track, costing $300,000. The St. Elmo branch will be extended, Harrison avenue line completed and the finishing touches will be put on to the Cowart and Carter street lines. Sixty new cars will be purchased.

* * The new power station for the Lynn and Boston Railway Company, which is to furnish power for 81 miles of rail, is completed and now the machinery is being put in. There are to be four tandem compound Corliss engines with a 48 inch stroke. The fly-wheels are 20 feet in diameter and weigh 20 tons each. There will be four M. P. 270 Thomson-Houston generators that will develop 360 horse-power. This is but one-half of the power that the company will have, as it will put in a whole duplicate of this machinery next Fall. There are 12 boilers of 700 horse-power to run the machinery. Those who will have charge are Mathew Holmes, chief engineer; Daniel Boyle, first assistant; Cyrus Reynolds, second. The engines will be started for the first time June 5.

### A Big Allis Engine for the World's Fair.

The chief motive power for the machinery at the World's Fair will be supplied by a gigantic engine, to be furnished free to the Exposition by the E. P. Allis Company, of Milwaukee. The engine will be furnished as a part of the company's exhibit, upon a special contract providing that it shall be used for the motive power, and that no other engine of equal size shall be exhibited. It will be an engine of the quadruple expansion type, and will be of between 3,000 and 4,000 horse-power. Compared with this engine the big Corliss that was exhibited at the Centennial Exposition is almost a dwarf. In 1876 the Corliss was considered one of the wonders of the exposition, but its builders rated it at only 1,400 horse-power, or less than half of the one being built by the Allis Company. The Allis exhibit represents an outlay of $175,000.

## RAILWAY TRAIN LIGHTING.

(*Continued from page 208.*)

or regulators, no matter how simple, would complicate the system and probably cause the total extinction of the light. Each car is provided with 32 cells of storage batteries, placed 16 in each of two boxes, securely fastened under the center, and directly over the truss rod. The weight of batteries and boxes complete is about 2,000 pounds. As already stated, with the system of wiring adopted, the batteries and lamps are permanently connected in multiple arc, so that should the train be parted and connection with the dynamo become broken the batteries will supply current necessary to maintain the light; or should the batteries under one car become disconnected its lamps will be supplied from batteries under other cars in the train.

The lamp equipment of a six-car Pullman train is as follows:

| | |
|---|---|
| Combined smoking and baggage car | 21 lamps. |
| Dining car | 32 " |
| Three sleeping cars | 90 " |
| Combined observation and sleeping car | 29 " |
| Total | 172 lamps. |

Of this number, 98 are 16 candle-power and 74 are 8 candle-power. The latter are placed in hallways, toilet rooms and vestibules.

During six months of the year, seven ⅛ horse-power fan motors are added, viz., 3 in the dining, 2 in the smoking and 2 in the observation cars, each absorbing the current of four 16 candle-power lamps, or a total of 28, which, added to the 172, makes the total 200 lamps in the train. To maintain the 200 lamps requires 144 amperes. As the dynamo will generate but 80, the batteries must supply 64 amperes, or 44 per cent. This is effected by charging the batteries during the day and part of the night *en route*, and while the train is standing in the yards.

The following, taken from the January records of a train, will give an idea of the number of lamp hours required:

CHICAGO TO JERSEY CITY.

| Time. | Hours. | No. of Lamps. | Lamp Hours. | |
|---|---|---|---|---|
| 4 A. M. to 9 P. M. | 5 | 172 | 860 | Leaving Chicago. |
| 9 " 11 " | 2 | 140 | 280 | |
| 11 " 12 " | 1 | 42 | 42 | |
| 4 " 7 " | 3 | 172 | 516 | Arr. at Jersey City. |
| During day in tunnels and depots | 1 | 172 | 172 | |
| Total | .. | .. | 1870 | |

JERSEY CITY TO CHICAGO.

| Time. | Hours. | No of Lamps. | Lamp Hours. | |
|---|---|---|---|---|
| 4 P.M. to 9.30 P.M. | 5½ | 172 | 946 | Leav'g Jersey City. |
| 9.30 " 11 " | 1½ | 140 | 210 | |
| 11 " 12 " | 1 | 42 | 42 | |
| 6 A.M. to 7.30 A.M. | 1½ | 32 | 48 | Arriv'g at Chicago. |
| During day in tunnels and depots | 1 | 172 | 172 | |
| Total | .. | .. | 1418 | |

Total, 3,288 lamp hours during the round trip.

The cost of an installation for a six-car Pullman train—consisting of one combined baggage and smoking, three sleeping, one dining and one combined sleeping and observation car is as follows:

COMBINED BAGGAGE AND SMOKING CAR.

| | |
|---|---|
| One Brotherhood engine | $500 |
| One Eickemeyer dynamo | 500 |
| 32 cells accumulators | 392 |
| Wiring | 100 |
| One set wire connectors | 11 |
| Battery boxes, crates and connections | 71 |
| Steam piping, lubricator gauges, etc | 155 |
| Voltmeter and ammeter | 77 50 |
| Safety switch | 12 |
| Lamps and sockets | 17 |
| Switches and cut-outs | 17 50 |
| Shades—holders and fixtures | 10 80 |
| Partition for dynamo and engine | 38 |
| Two ⅛ horse-power fan motors | 76 |
| Miscellaneous | 50 |
| | $2,027 80 |

SLEEPING CAR.

| | |
|---|---|
| 32 cells accumulators | $392 |
| One set wire connectors | 11 |
| Wiring | 90 |
| Battery boxes, crates and connections | 71 |
| Lamps | 15 |
| Sockets, receptacles, etc | 47 |
| Switches and cut-outs | 17 50 |
| Shades and shade holders | 9 |
| Berth lamps | 90 |
| Miscellaneous | 20 |
| | $762 50 |

DINING CAR.

| | |
|---|---|
| 32 cells accumulators | $392 |
| One set wire connectors | 11 |
| Wiring | 70 |
| Battery boxes, crates and connections | 71 |
| Lamps | 16 |
| Receptacles and fixtures | 32 |
| Switches and cut-outs | 17 50 |
| Three ⅛ horse-power fan motors | 114 |
| Miscellaneous | 20 |
| | $743 50 |

COMBINED SLEEPING AND OBSERVATION CAR.

| | |
|---|---|
| 32 cells accumulators | $392 |
| One set wire connectors | 11 |
| Wiring | 90 |
| Battery boxes, crates and connections | 71 |
| Lamps | 14 50 |
| Sockets, receptacles and fixtures | 19 50 |
| Shades and holders | 10 40 |
| Berth lamps | 45 |
| Two ⅛ horse-power fan motors | 76 |
| Miscellaneous | 20 |
| | $749 40 |

A total of $5,808.20, or an average of $968 per car.

As the fan motors are used but six months in the year, the average number of lamps will be 172 + 14 = 186. Therefore, the cost of equipment per lamp will be $5,808.26 ÷ 186 = $31.22.

The average cost of labor and material for maintaining the lighting of three trains, or 18 cars for 19 months, from August, 1890, to February, 1892, inclusive, was as follows:

| | |
|---|---|
| Average total cost per month | $1,265 95 |
| " " per car per day | 1 99 |
| " " of labor per month | 712 39 |
| " " per car per day | 1 11 |
| " " of material per month | 511 51 |
| " " per car per day | 87 |
| " " per lamp per day | 07.17 |
| Average number of lamps in use | 558 |

The item of labor includes the wages of five attendants on the train at $3 per day each, and two men at each terminal station at $90 and $55, and $75 and $50 per month, respectively.

That of material includes the cost of renewal of batteries, etc.

The cost of labor is practically constant, while that of material varies from 12 cents to $2.04 per car per day, the average for 19 months being 87 cents. The cost per lamp per day varies from $3\frac{8}{15}$ to $12\frac{6}{15}$ cents; the average is 7.17 cents.

The cost of power furnished by the locomotive boiler is not included in the statement, for the reason that a satisfactory measurement of the quantity of the coal and water used has never been made.

So long as the dynamo can be run, and the batteries properly charged, the system is reliable.

During the coldest part of the Winter, or as sometimes happens, when a poor quality of coal is furnished, it is difficult for the locomotive to supply sufficient steam to run the dynamo. In such cases the batteries are called upon to maintain the light. As a rule, they have sufficient charge to do so for about four hours. Trains so equipped have been run between Jersey City and St. Augustine, Florida, during the months of January, February, March and April of each year since 1888.

The conditions there are decidedly more favorable, for the reason that the trains leave both terminals early in the morning. In consequence, the dynamo is run nearly all day, and the batteries are, therefore, fully charged and in condition to furnish current for the maximum number of lamp hours. So successful has been the electric lighting of these two trains, that it is rare for other sources of illumination to be used. The system has also been used on other trains, viz., between New Orleans and the city of Mexico, Omaha and San Francisco, Chicago and Portland, Me.

Several specials have also been similarly lighted, notably—the Presidential, from Washington to San Francisco and return; the National Electric Light Association trains, between Jersey City and Chicago, and Jersey City and Kansas City; the National Telephone Exchange Association train to Minneapolis, and that of the Pan-American delegates, which was almost constantly on the road for three weeks.

A duplicate of this system was tried for a short time on the Chicago, Milwaukee and St. Paul Railway. I must look to others to explain the causes for its being abandoned, and also describe that which has been substituted and which it is understood has proven very satisfactory. One of the most serious sources of trouble met with in train lighting was the effect of the vibration of the car on different members of the plant. At first it was almost a daily occurrence to have lamps drop out of sockets—the shade holders, which were made of thin sheet brass, were broken at the rate of eight or ten during one trip. Trains would arrive at terminal stations with two or three batteries out of circuit caused by connections between cells being broken. In the earlier days it was the practice to use a rigid connection between battery cells, as it was considered best to prevent the elements moving in the rubber jar. It was soon discovered that the element would move irrespective of the rigid connection, and in doing so would break the terminal, and in a majority of cases the fracture was next to the plates. As we had no means of burning the lug on again, the element was useless. To overcome this difficulty flexible connections were substituted. Contrary to all expectation no damage was done by the movement, and since then should a terminal be broken, which, however, is seldom, it is in every instance due to a defect in burning on at the factory. Cast brass shade holders were substituted for those of sheet brass. To prevent shades working loose and dropping out, ordinary rubber bands were placed under the lip, against which the holder screws were driven, and they having a soft foundation were prevented turning and held the shade in place. The cause of the lamps falling out was due, in a great measure, to the socket rings working loose. This was overcome by the invention of a tool that would drive the ring into place much tighter than was possible by hand. Many minor causes of trouble that could not be foreseen were eliminated as fast as they developed.

A system of safety cut-outs was devised that protect each wire in the car. They are placed on the same baseboard with the lamp switches, and are located in the locker or closet, convenient for inspection and renewal. Later on portable lamps were demanded that could be placed in the sleeping car sections, either before or after the berths had been made up. For this purpose No. 18 wire was connected to one of the lamp circuits on the roof, and led to a connecting block placed over the mirror between the windows in each section. Connection with the block was made with a plug, to which flexible lamp cord was attached. On the other end of the cord a frosted 16 candle-power lamp was connected, the lamp hanging from an arm which was placed in a receptacle in the corner formed by the side of the car and the partition between sections, and immediately over the shoulder of the passenger, the most favorable position for the lamp when used for reading.

It was early seen that the only uncertainty connected with the system is due to the absolute dependence upon the locomotive boiler for power to run the dynamo, for, as explained, there is a constant liability of the failure of the steam supply which, if prolonged beyond the capacity of the battery will result in the use of oil or gas for light. As many other problems connected with the system have been sucessfully worked out, it is believed that the solution of this one will also be found.

There is no doubt that the ideal way of running the dynamo is by a connection with the axle. Many apparent solutions have been suggested, only to be condemed as uncertain or impracticable. It is, however, thought that within the next year a reliable connection will be had, after which I believe the lighting of railway trains by electricity will be universally adopted.

### A Handsome Catalogue.

One of the handsomest and most complete catalogues that has been received at the office of the ELECTRICAL REVIEW is that just sent out by the Thomson-Van Depoele Electric Mining Company, of Boston. It is in flexible pamphlet form of large size and is a fine example of the printers' art. The illustrations are profuse and well executed, and the catalogue contains illustrations and descriptions of everything electrical that could possibly be required for the equipment of a mine in the most modern and approved style. A number of very valuable tables and several examples of installations in mines are given. The benefits of electricity, as applied to mining operations, are so well known that they need no argument, and yet those in quest of such apparatus as is required in a well equipped mine are in need of detailed information, which is very often hard to procure. To such persons we would recommend for their careful perusal the catalogue mentioned here. It is replete with valuable information presented in such a manner that the layman can thoroughly understand it.

### A Subterranean Jest.

McWatty—"I have thought of a good motto for the telegraph wires."

Hilow—"What is it?"

"There is plenty of room under ground."
—*Detroit Free Press.*

The Bement, Ill., Electric Light and Power Company has increased its capital stock from $2,000 to $5,000.

## Culled from the Lay Press.

WHAT IT IS.

The telephone has been described as an arrangement by which two men can lie to each other without blushing.—*Westerly, R. I., Tribune.*

NO DIVIDENDS.

Telephonic communication will cease at Rome, owing to the fact that the office will not pay $4 per month.—*Towanda, Pa., Reporter.*

DU BOIS AND THE COMPUTATOR.

The computator at the electric light plant burned out last week and left us without arc lights. Du Bois came over from Newport and put in a new one Saturday, and it is now running all right.—*Bellows Falls, Vt., Times.*

BLESSED THE DYNAMOS.

A rather curious ceremony has taken place near Poictiers. The electric light has just been laid on in the parish of St. Philomen, and the bishop of the diocese solemnly blessed the dynamos. A special ritual has been composed for the ceremony.—*Galignani's Messenger.*

RATS DIDN'T LIKE IT.

A. L. Calkins purchased one of the patent French rat traps Thursday and caught 12 large rats the first night. Yesterday an effort was made to electrocute them with an induction coil, but the only effect was to cause them to perform some lively dancing whenever they got in the circuit, but did not remain quiet long enough to get a full charge.—*Hartford, Conn., Post.*

"HELLO" GIRLS' UNION.

It is reported that 400 Chicago telephone girls will form a labor union before the Fourth of July.

When the telephone girls and the typewriters combine in the sisterhood of federated labor, will the keyboard and the switchboard act in harmony to control the small talk and the general correspondence? It behooveth subscribers and employers to be deferential.—*Chicago Inter-Ocean.*

TWICE ONE IS TWO.

Walton is agitating the question of electric lighting the streets. A proposition to pay the Walton Electric Light Company $1,600 for one year's lighting is to be voted on May 25.—*Courier.*

Don't see how they can do it. Electricity must be less expensive in Walton than Deposit. It ought to cost Walton double what it does Deposit, because the former is more than double in size.—*Deposit, N. Y., Journal.*

ELECTROCUTION BY TREE POWER.

Speaking of electricity recalls the fact that I was once told by an electrician that a person leaning against a tree through which electric wires pass, as in this town, is liable to meet death at almost any moment, especially if the tree is damp. Dampness is a conductor, and a live wire lying against a limb will charge the tree so heavily that a person touching the trunk may be electrocuted. In my ramblings through town I find the electric light wires passing through the trees, and if they are as dangerous as I have been told the fault should be remedied at once.—*Columbia, Pa., News.*

A PROGRESSIVE PRIEST.

The coming election in Sharpsburg on the question whether the borough will erect an incandescent electric light plant is causing a great deal of interest. There is some talk that a quiet canvass is being made against the issue. A new move was made in the matter yesterday. Father Schwab called the attention of his members to the approaching election. He told them that electricity was the only light, and that it was a great deal better to have the borough operate the plant than a private company. He thought it the duty of every citizen to vote for light.—*Pittsburgh Dispatch.*

A NOVEL TROLLEY POLE.

Charles Davis is one of the best conductors on the street railway. He is not only accommodating and gentlemanly, but is always awake to the company's interests. On Sunday Charlie exchanged cars at the post office with one of the other conductors, and he had gone but a short distance when the trolley pole broke, entirely disabling the car. But this did not cut much of a figure with Charles, for quick as a cat he was on top of the car, and although it almost broke his arm, he held the broken trolley pole against the wire, and the car sailed merrily on to the barn. It is hard for the electric cars to get ahead of Mr. Davis.—*New Brighton, Pa., News.*

THE CAT PARALYZER.

The latest electrical invention is the cat paralyzer. It is a very simple device and any one can kill all the cats in a 100 miles if they feel so disposed. First secure a cat skin—tom cat preferred. Inflate the skin by means of a pneumatic tube. Connect the cat's tail with the trolley wire of the railway by means of a copper wire, any length desired. Place the inflated cat skin in your front yard, the electrical current passing through the cat will cause it to bow its back as if seeking trouble. Your neighbor's cats on seeing this piece of ingenuity will tackle it—but they will never tackle another. The instant he places his claws into this electrified cat he is electrocuted. The inventor killed 100 members of the feline family in one night. Agents wanted everywhere.—*Paducah, Ky., News.*

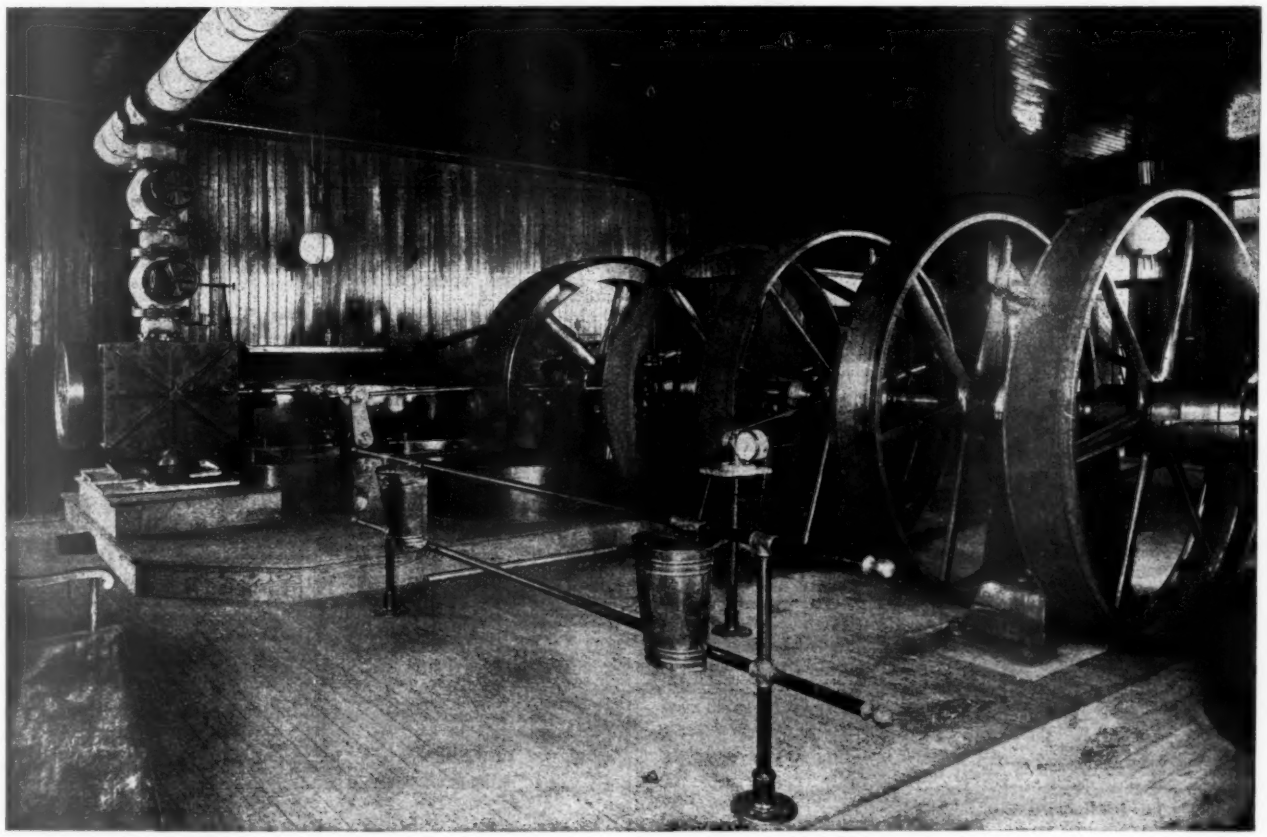
## Electric Lighting Plant at Easton, Pa.

About two years ago the city of Easton, Pa., found it necessary to enlarge their electric light plant, and the contract was awarded to the Jno. T. Noye Manufacturing Company, of Buffalo, N. Y., whose reputation in this field of work is so well known.

They decided to remove the old steam plant altogether, and in its place installed two engines of 200 horse-power each, of the Henry Doty "B" type.

The cylinders of these engines are 18 inch bore and 24 inch stroke, running at 170 revolutions. An intermediate shaft, supported on handsome cast iron pedestals and fitted with four 84 inch drive pulleys, was placed between the two engines and connecting with both.

Steam is supplied by three boilers 74 inches in diameter and 16 feet 6 inches long, with 126 three inch tubes in each boiler. There is also one 400 horse-power Wainwright horizontal heater, and a complete outfit of the Weitmeyer improved gas and smoke consuming furnaces. The smoke-stacks are 45 inches in diameter and 70 feet high, and the entire plant is fitted out with every known modern improvement.



INTERIOR VIEW OF MUNICIPAL ELECTRIC LIGHTING STATION AT EASTON, PA., STEAM PLANT INSTALLED BY THE JOHN T. NOYE MANUFACTURING COMPANY, OF BUFFALO, N. Y.

—— The capstone of the new Mormon temple at Salt Lake City was recently set by electric power. A heroic statue of the Angel Moroni will surmount one of the towers and will be illuminated by electric light like Diana of Madison Square.

## ELECTRIC LIGHT NEWS

—— The court has decreed the Sharon, O., Electric Light Company dissolved as a corporation.

—— The Toledo, O., Electric Light Company uses crude oil for fuel at the rate of 100 barrels a day.

—— The Skowhegan, Me., Electric Light Company has declared a semi-annual dividend of three per cent.

—— The Seymour, Conn., Electric Light Company has increased its capital stock from $15,000 to $21,000.

—— The Detroit Electric Light and Power Company has purchased the land on which its plant is situated for $30,000.

—— The electric light plant at Irwin, Pa., was struck by lightning last week, and Julius Berger, the electrician, was so badly injured that he will probably die.

—— The Canton, Pa., Electric Light Company is talking of utilizing the water from Lake Nephawin, near that place, for power. There is a fall of 365 feet.

—— An amended certificate of incorporation of the Pacific Lighting Company, of San Francisco, has been filed, its expanding business having made it necessary to enlarge the purposes for which it was incorporated.

—— A new electric light company, to be controlled by the Westinghouse interests, is promised for San Francisco. The plant, it is said, will cost about $1,000,000, and the investment is to be made by the Westinghouse Company, of Pittsburgh, James G. Fair and other capitalists.

—— The stockholders of the Edison Electric Illumination Company, of New York, at their recent annual meeting voted by a two-thirds vote to increase the capital stock from $2,000,000 to $6,500,000 to be used in improvements. It is said that the issue of $1,000,000 five per cent. gold bonds will be authorized and that stockholders of record June 11 will be granted rights to subscribe.

## KINDRED INTERESTS

**The Backus Manufacturing Co.,** of Williamsport, Pa., has sent us a descriptive catalogue of the Backus portable steam heater. Gas is used for fuel, and it has been endorsed by experts as being economical, cleanly and healthy.

**The Jersey City and Bergen Railroad Company,** of which Mr. C. B. Thurston is president, has just closed an important contract with the Ball & Wood Company, of New York, for three of their improved cross compound engines of 300 horse-power each. The contract was awarded after lively competition. The intention of the company is to make the plant which will operate its lines a model one, not only in respect to the latest and most approved type of engines, but in its other equipment and arrangement.

**The Rose Polytechnic Institute** is one of the few well-endowed and well-equipped schools of a college grade in the United States devoted exclusively to the professional education of mechanical, electrical and civil engineers and chemists. Very special attention is devoted to electricity. It is the strongest possible evidence in favor of this school that for several years the number applying for admission has exceeded the limited number that can be admitted. Those intending to study engineering should address Rose Polytechnic Institute, Terre Haute, Indiana, for catalogue.

**"The City of Easton.** One of Our Electric Light Plants" is the title of an interesting and handsomely illustrated pamphlet issued by the John T. Noye Manufacturing Company, of Buffalo. This company enlarged the city's plant—in fact, almost rebuilt it—and installed two of their heavy duty engines of 200 horse-power each. The cylinders are 18 inch bore and 24 inch stroke, the engines running at 170 revolutions. The governor is in the fly-wheel. An intermediate shaft is placed between the two engines connecting to each engine by suitable clutch couplings with four 84 inch drive pulleys on the shaft. The John T. Noye Manufacturing Company also supplied three boilers of 74 inches diameter and 16 feet 6 inches long, with 126 three inch tubes in each boiler.

**The American Electric Supply Company,** of Buffalo, N. Y,, have recently installed a rather novel plant in the organ loft of St. Stephen's Church in that city for running the large organ. It consists of a one horse-power "C. & C." motor supplied with current from a street railway circuit of 500 volts. A rheostat in connection with the bellows, to the crank of which the motor is coupled, controls the speed of the motor and insures a steady air pressure at all times. The outfit is the first one of the kind to be used for this purpose, and is giving excellent satisfaction. The same company are now putting in a 500 light incandescent plant in the new law building at Ithaca, N. Y., and a 200 light plant at Parkers, Pa., the contract for the latter including "C. & C." dynamos and a 20 horse-power Rice automatic engine.

**The Railway Equipment Company,** Chicago, reports business as rushing in all departments. They have added largely to the established business of the Electric Merchandise Company, whose business they purchased some few weeks since. Owing to the fact of the standard appliances of this company having such an established reputation, a very large number of late contracts for equipment have been made with the understanding that such appliances will be used. The company reports a largely increased business over the last season, but having increased its manufacturing facilities, it is able to guarantee immediate shipments. The managers of the company having devoted their entire time and attention to "electric railway supplies only" for several years, are prepared to furnish reliable and complete information to parties about to equip electric street roads. Such inquiries are given most careful attention, are answered fully and without charge.

**The Short Electric Railway Company,** Cleveland, report orders for additional apparatus from the Bloomington City Railway Company, Bloomington, Ill., ten 40 horse-power single reduction equipments and one 100 horse-power generator; South Covington and Cincinnati Street Railway Company, four 40 horse-power single reduction equipments; Schuylkill Electric Railway Company, Pottsville, Pa., four 50 horse-power single reduction equipments; West End Street Railway Company, Rockford, Ill., six 20 horse-power gearless equipments; Georgetown and Tenallytown Railway Company, Washington, D. C., two 40 horse-power single reduction equipments; Wilkesbarre and Wyoming Valley Traction Company, Wilkesbarré, Pa., three 60 horse-power single reduction equipments, one 200 horse-power generator; and the Braddock Electric Railway Company, Braddock, Pa., one 40 horse-power single reduction equipment. They have also closed contracts recently with the Baltimore Traction Company, Baltimore, Md., and the Janesville Street Railway Company, Janesville, Wis.

**Ball Engine Company, Erie, Pa.**—The Schuylkill Electric Railway Company, Pottsville, Pa., have recently placed a 200 horse-power Ball engine. J. C. Hubinger Electric Light Company, of Keokuk, Iowa, have just installed a 300 horse-power cross compound condensing Ball engine. F. R. Dravo & Company, the Pittsburgh representatives of the Ball Engine Company, Erie, Pa., manufacturers of the Ball automatic cut-off engine, recently furnished one 50 and one 100 horse-power engine to the Pittsburgh Iron and Steel Engineering Company, Pittsburgh; one 120 horse-power engine to the Moundsville Electrical Company, Moundsville, W. Va.; and one 80 horse-power engine to the Oakland Light and Power Company, Oakland, Md. Crook, Horner & Company, Baltimore representatives of the Ball Engine Company, Erie, Pa., have recently furnished two 150 horse-power engines of this manufacture to the North Avenue Street Railway Company, Baltimore, and two 150 horse-power tandem compound condensing engines and complete steam plant to the Chesapeake Light and Power Company, Hampton, Va. The Niagara Falls Street Railway Company, Niagara Falls, N. Y., are erecting a power plant at that point. The Ball Engine Company, Erie, Pa., are furnishing the steam plant, consisting of two 130 horse-power engines, two 130 horse-power boilers, pump, heater, etc. The City of Elizabeth, N. C., has just started a 100 horse power Ball engine.

**Russell & Co.,** the well known engine builders, are making very large additions to their factory at Massillon, O., more especially in the department devotedto the manufacture of automatic engines. They report the following sales of automatic engines since February 1, 1892:

C. S. Waldorf & Co., South Bend, Ind., 60 horse-power; Deer Park Electric Co., Port Jarvis, N. Y., 150 horse-power; Jackson County Court House, Kansas City, Mo., 150 horse-power; Oshkosh Electric Light and Power Co., Oshkosh, Wis., two engines, tandem compound, 500 horse power; J. L. Diven & Co., Hot Springs, S. D., 50 horse-power; Love Bros., Piedmont, O., 45 horse-power; Western Electric Co., Chicago, Ill., factory, tandem compound, 330 horse-power; Opera House, Charleroi, Pa., 25 horse-power; Lindsay Bros., Milwaukee, Wis., 50 horse-power; The Cleveland Stone Co., Berea, O., 100 horse-power; Petaluma Electric Light Co., Petaluma, Cal., 65 horse-power; Philadelphia Home for Aged and Infirm, Philadelphia, Pa., 25 horse-power; Marks Bros., Philadelphia, Pa., 35 horse-power; Nordyke & Marmon Co., Noblesville, Ind., two engines, 150 horse-power; John P. Martin, Wellston, O., two engines, 150 horse-power; Printers' Publishing Co., New York City, 125 horse-power; Western Electric Co., Prairie City, Ill., 45 horse-power; The W. P. Southworth Co., Cleveland, O., 25 horse-power; Northwestern Terra Cotta Co., Chicago, Ill., 60 horse-power; Schmulbach Brewing Co., Wheeling, W. Va., 25 horse-power; Hale Block, St. Paul, Minn., two engines, 50 horse-power; Huyett & Smith Manufacturing Co., St. Paul, Minn., 25 horse-power; San Antonio Brewing Association, San Antonio, Tex., 25 horse-power; Western Beet Sugar Co., Watsonville, Cal., 80 horse-power; Vernon Light and Water Co., Talapoosa, Ga., 100 horse-power; Somerset Electric Light, Heat and Power Co., Somerset, Pa., 100 horse-power; Congdon Brake Shoe Co., Englewood, Ill., 80 horse-power; Chartiers Valley Electric Light, Heat and Power Co., Mansfield, Pa., two engines, 300 horse-power; Van Winkle & Files, Hillsboro, Tex., 100 horse-power; Wrought Iron Bridge Co., Canton, O., 110 horse-power; The Akron Heating and Ventilating Co., Akron, O., 100 horse-power; S. F. Knapp & Co., Atlanta, Ga., 60 horse-power; Wayne County Court House, Richmond, Ind., 50 horse-power; Massillon Light, Heat and Power Co., Massillon, O., two tandem compound, 400 horse-power; Asbury Park Electric Light, Heat and Power Co., Asbury Park, N. J., 150 horse-power; Excelsior Pebble Phosphate Co., New York City, 100 horse-power; Madison Electric Co., Madison, Wis., two tandem compound, 500 horse-power; the Metropolitan Hotel, St. Paul, Minn., two engines, 70 horse-power; Logansport Manufacturing Co., Logansport, Ind., 100 horse-power; Columbus Manufacturing Co., Columbus, O., 125 horse-power; W. H. McIntyre, Butler, Ind., 150 horse-power; Liggett & Myers Tobacco Co., St. Louis, Mo., 150 horse-power; The West Michigan Furniture Co., Holland, Mich., 200 horse-power; Defiance Light and Power Co., Defiance, O., 150 horse-power; De Land Manufacturing Co., De Land, Fla., 75 horse-power; Moreman & Davis, Plano, Tex., 75 horse-power; Canton Street Railway Co., Canton, O., 150 horse-power; D. May & Co., "The Famous," St. Louis, Mo., two engines, 250 horse-power; Electric Light and Power Co., Carterville, Ill., 60 horse-power; Cantine & Co., Crestline, O., 100 horse-power; Garrett Electric Light Co., Garrett, Ind., 150 horse-power; Jas Overholt & Son, Powerston, O., 25 horse-power; Lost Run Coal Co., Nelsonville, O., 125 horse-power; Alex. McConkey, Findlay, O., 25 horse-power; the Toledo Express, Toledo, O., 25 horse-power; Geo. T. Parrish, Centerville, Utah, 35 horse-power; the Knox Estate, St. Louis, Mo., two engines, 175 horse-power; Ohio Valley Planing Mill Co., Evansville, Ind., 100 horse-power; Pittsburgh and West End Traction Co., Pittsburgh, Pa., four engines, 800 horse-power; the Cincinnati City Hall, Cincinnati, O., three engines, 300 horse-power; Electric Light and Power Co., Moscow, Idaho, 125 horse-power; John W. Young, Dallas, Tex., 50 horse-power; Allen Seidel, Portland, Ore., two engines, 160 horse-power; the Electric Light Co., Prospect, O., 60 horse-power; the Put-in-Bay Hotel Co., Put-in-Bay Island, O., two engines, 500 horse-power; F. W. Schellhase, Tell City, Ind., 100 horse-power; the Hyman Block, Cincinnati, O., 60 horse-power.


## Chicago World's Fair.

An Engineer for Electrotechnic.—A German, with knowledge of the English and French language, with a collegiate education, wishes to obtain a situation for the construction and duration of the exhibition with a prominent firm.

Offers stating salary to be addressed to

"H. I. 1182,"

Care, RUDOLPH MOSSE,

HAMBURG, GERMANY.

## WANTED TO BUY.

High speed Engines, Dynamos, Boilers and Electrical Apparatus. Must be in good condition. Give full description, terms, price in first letter. We refer to Bradstreet, Dun, Denver National Bank.

**F. P. ARBUCKLE,**

*Highlands, Denver, Colo.*

## FOR SALE.

One 10 H. P. Baxter Motor.
One 5 " " "
One 3 Arc Light Dynamo.
One 25 Incandescent Light Dynamo, 220 volts.
One 15 " " 110 "
One 2 H. P. Motor, 500 volts.
One 1 " " 500 "

All in good condition.

**A. H. ARP,**
511 FIFTEENTH STREET,
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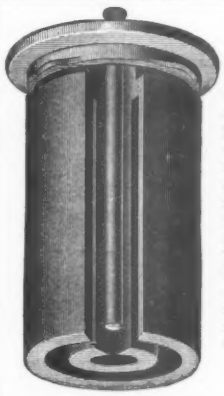

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